

**MODEX-OPTS-TX
MODEX-OPTM-TX
MODEX-OPTS-RX
MODEX-OPTM-RX**



SAFETY INSTRUCTIONS

Class I apparatus construction. This equipment must be used with a main power system with a protective earth connection. The third (earth) pin is a safety feature, do not bypass or disable it.

This equipment should be operated only from the power source indicated on the product.

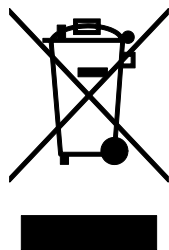
To disconnect the equipment safely from power, remove the power cord from the rear of the equipment, or from the power source. The MAINS plug is used as the disconnect device, the disconnect device shall remain readily operable.

There are no user-serviceable parts inside of the unit. Removal of the top cover will expose dangerous voltages. To avoid personal injury, do not remove the top cover. Do not operate the unit without the cover installed.

The apparatus shall not be exposed to dripping or splashing and that no objects filled with liquids, such as vases, shall be placed on the apparatus.

The apparatus must be safely connected to multimedia systems. Follow instructions described in this manual.

WEEE (Waste Electrical & Electronic Equipment)



Correct Disposal of This Product

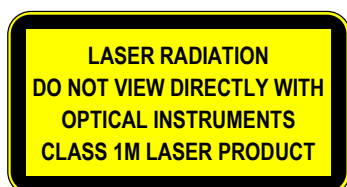
This marking shown on the product or its literature, indicates that it should not be disposed with other household wastes at the end of its working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate this from other types of wastes and recycle it responsibly to promote the sustainable reuse of material resources.

Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take this item for environmentally safe recycling.

Business users should contact their supplier and check the terms and conditions of the purchase contract. This product should not be mixed with other commercial wastes for disposal.

Caution: Laser product

This laser product is designated as Class 1M, wavelengths are 850 nm, 1310 nm, 1490 nm, 1550 nm.





DECLARATION OF CONFORMITY

We,

Lightware Kft. 1071 Budapest Peterdy str. 15 HUNGARY

as manufacturer declare, that the products

**MODEX-OPTS-TX
MODEX-OPTM-TX
MODEX-OPTS-RX
MODEX-OPTM-RX**
(Computer Monitor Extender)

in accordance with the EMC Directive 2004/108/EC and the Low Voltage Directive 2006/95/EEC are in conformity with the following standards:

EMI/EMC EN 55103-1 E3, EN 55103-2

Safety EN 60065 Class I

Date: 1 April 2014

Name: Gergely Vida (Managing Director)

Signed:

A handwritten signature in black ink, which appears to read 'Vida A. Gergely'. The signature is written in a cursive, flowing style.

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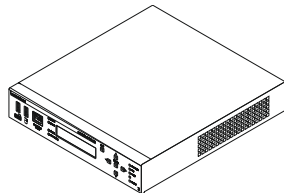
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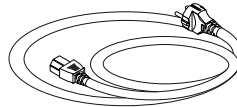
1. Introduction

Thank you for choosing MODEX, the Lightware Modular Extender family. The MODEX family is a hybrid, modular and multi-layer group of extenders supporting AV and broadcast industry's formats. Capable of extending digital and analog audio and video, USB KVM, Ethernet and control signals like RS-232, RS-422 or Infrared.

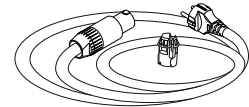
1.1. Box contents



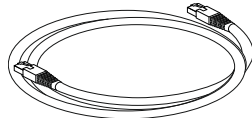
MODEX transmitter or receiver



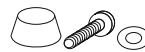
Power cable with IEC connector¹



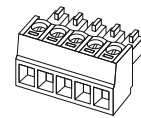
Power cable with Neutrik powerCON connector and additional chuck²



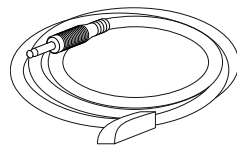
UTP patch cable (1 m)



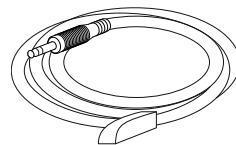
Rubber foot with screw and washer (4x)



Phoenix® Combicon (3.5mm pitch) connector³



Infrared transmitter with TRS male connector⁴



Infrared receiver with TRS male connector⁴

1.2. Description

The technology built into the MODEX family breaks many standard limitations allowing 30 meters DVI cable on input, Advanced EDID Management, Pixel Accurate Reclocking, LAN and RS-232/RS-422 control.

The half unit extender allows one video & audio module and two interface modules (each can be the same or different type). The front panel has an additional 10/100 Mbps Ethernet port (with full functionality, but can be used as a control interface) and USB KVM connectors (transmitter has one USB-B for the computer; receiver has two USB-A connectors for a keyboard and a mouse). Keyboard and mouse functions are emulated by the extender and no USB enumeration occurs while operator switching.

MODEX includes a family of long distance transmitters and receivers for sending and receiving video, audio, RS-232 and IR control, USB KVM and Ethernet over a single fiber cable. Media connector, the heart of the MODEX determines the signal transportation type as well as the direction (the unit is a transmitter or receiver).

The MODEX is fully compatible with the 25G hybrid architecture.

¹ Except the following media connectors: MODEX-CON-OPTS-NT-PCN and MODEX-CON-OPTM-NT-PCN.

² For the following media connectors: MODEX-CON-OPTS-NT-PCN and MODEX-CON-OPTM-NT-PCN.

³ For the following modules: MODEX-IF-AUDIN and MODEX-IF-AUDOUT (1-1 pc.), MODEX-IF-AUD (2 pcs.)

⁴ For the following module: MODEX-IF-RS232-IR

1.3. Features⁵

- **Front panel control** – EDID emulation, Network settings, Preset handling and the most important module settings are available on LCD-based menu with navigation buttons.
- **Built-in web page** – Easy access from a Web browser to control and configure the MODEX pair.
- **Built-in universal power supply** – The extenders are equipped with a built-in universal power supply, which accepts AC voltages from 100 to 240 Volts with 50 or 60 Hz line frequency.
- **Front panel LEDs** – Audio, Video, Optical Link and PSU LEDs to get immediate feedback about the signals and link status.
- **Pixel accurate reclocking** – The video output on the receiver has a clean, jitter free signal, eliminating signal instability and distortion caused by long cables or connector reflections.
- **Advanced EDID Management** – User can emulate any EDID on video input ports, read out and store any monitor's EDID.
- **HDCP enable / disable** – MODEX extenders are HDCP-capable ones. To display unprotected content on a non-HDCP capable sink, HDCP can be disabled via the front panel menu or from a web browser by the built-in web page.
- **Single fiber technology** – MODEX-OPTS and -OPTM extenders give optical transmission over a single or duplex fiber; equipped with a Neutrik OpticalCON or industrial grade connector but both can be used with LC fiber cable.
- **USB K+M** – Connected USB HID devices (e.g. keyboard, mouse) are extended from transmitter to receiver thus a computer can be remote controlled.

1.4. Applications

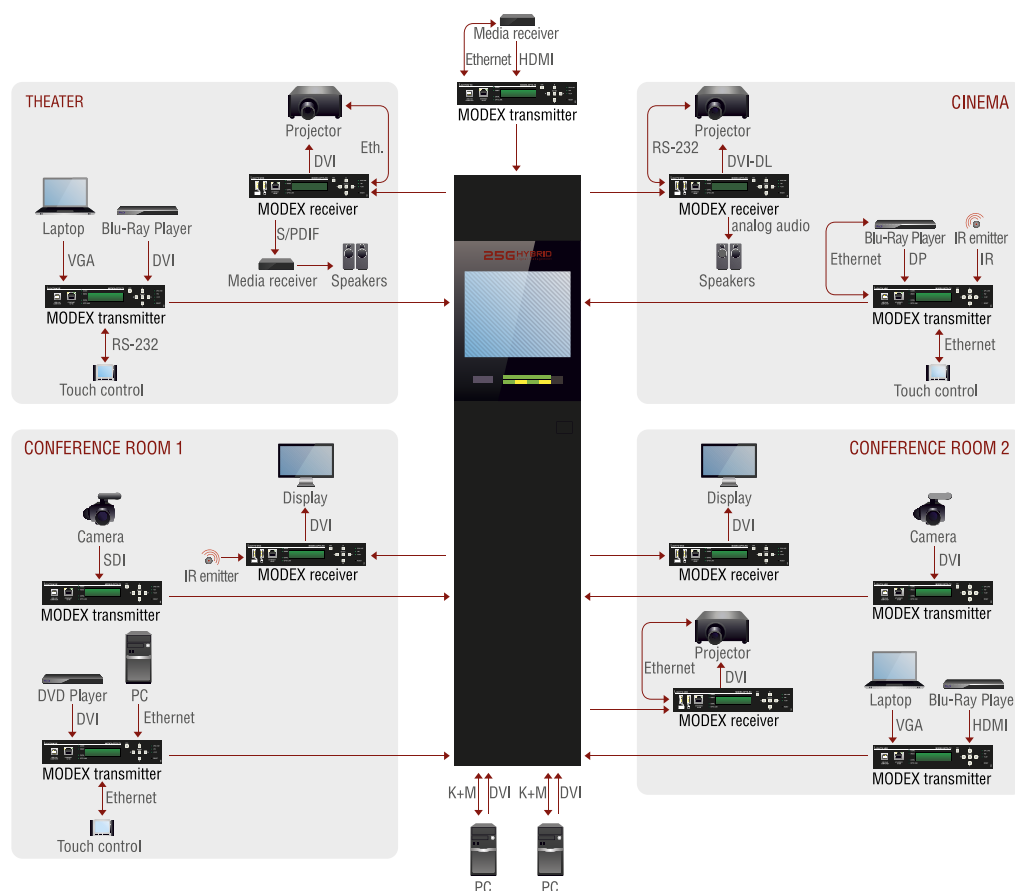


Figure 1-1. Integrated system

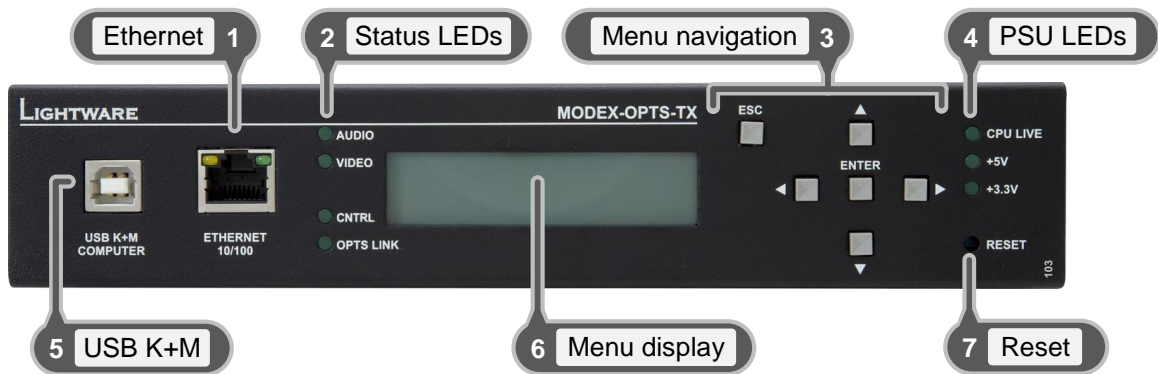
⁵ The available features depend on the modules installed into the given MODEX product.

2. Controls and connections

2.1. Frames

2.1.1. Transmitter front view

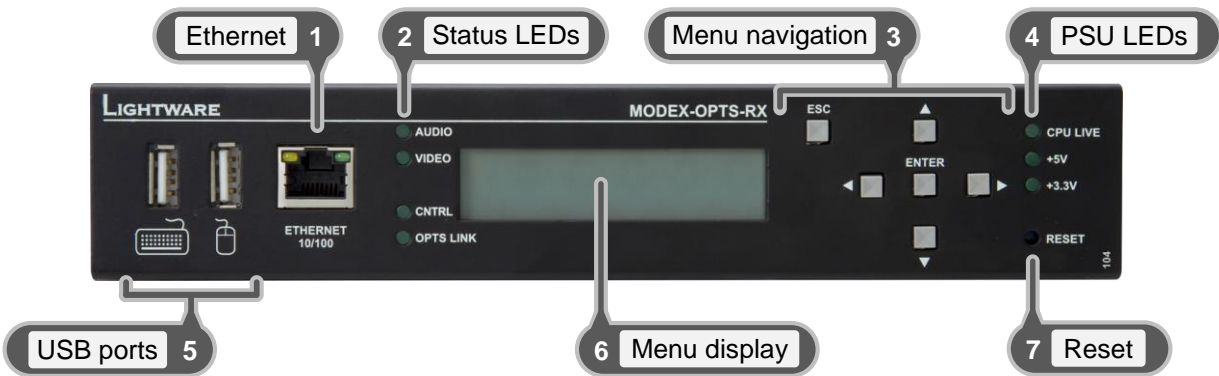
Info: MODEX-OPTS frames can be seen on the photos which look almost the same as MODEX-OPTM frames. Their housing contains just two differences: the 'OPTM' designation and the part number.



- | | |
|--------------------------|---|
| 1 Ethernet | Locking RJ45 socket. Remote control port for connecting the unit to Local Area Network (LAN). |
| 2 Status LEDs | Audio LED lights green when the audio transfer is active. Video LED indicates correct video transmission. CNTRL LED is green when low speed handshake of the extenders is complete. OPTS LINK LED lights when optical link is active. |
| 3 Menu navigation | Up, down, left, right, enter and escape buttons for menu navigation. |
| 4 PSU LEDs | CPU live LED blinks to indicate normal operation. +5V and +3.3V LEDs light green when the extender is powered on. |
| 5 USB K+M | USB connection to HOST (Computer) unit via USB B-type connector. |
| 6 Menu display | Displays status information and menu operation on the LCD with 2x16 characters. |
| 7 Reset | Reset button reboots the extender. This is the same as disconnecting from power source and reconnecting again. |

2.1.2. Receiver front view

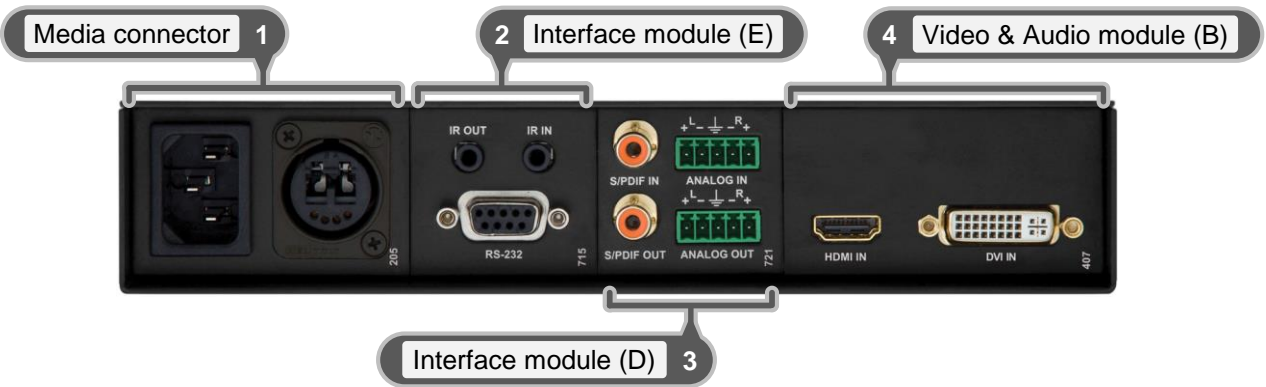
Info: MODEX-OPTS frames can be seen on the photos which look almost the same as MODEX-OPTM frames. Their housing contains just two differences: the 'OPTM' designation and the part number.



- | | |
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| 3 Menu navigation | Up, down, left, right, enter and escape buttons for menu navigation. |
| 4 PSU LEDs | CPU live LED blinks to indicate normal operation. +5V and +3.3V LEDs light green when the extender is powered on. |
| 5 USB ports | USB K+M ports for HID ¹ devices (preferably Keyboard and mouse). See more information in section 4.4 on page 25 . |
| 6 Menu display | Displays status information and menu operation on the LCD with 2x16 characters. |
| 7 Reset | Reset button reboots the extender. This is the same as disconnecting from power source and reconnecting again. |

2.2. Rear view

MODEX can be supplied with many kind of interface modules, thus the rear view of the extenders are different. Following example shows the structure of the installed modules.



¹ HID: Human Interface Device

2.3. Media connectors



MODEX-CON-NT-OPTS

Part nr. 9161 0227



MODEX-CON-NT-OPTM

Part nr. 9161 0228



MODEX-CON-OPTS-ODVA

Part nr. 9161 0229



MODEX-CON-OPTM-ODVA

Part nr. 9161 0230



MODEX-CON-OPTS-NT-PCN

Part nr. 9161 0231



MODEX-CON-OPTM-NT-PCN

Part nr. 9161 0232



MODEX-CON-OPTS-ST

Part nr. 9161 0235



MODEX-CON-OPTM-ST

Part nr. 9161 0236



MODEX-CON-OPTS-SC

Part nr. 9161 0237



MODEX-CON-OPTM-SC

Part nr. 9161 0238

2.4. Video & Audio modules



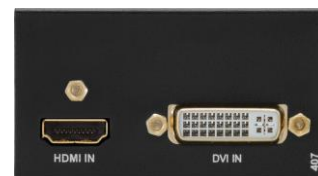
MODEX-AV-DVIDL-IM

Part nr. 9161 0401



MODEX-AV-DVIDL-OM

Part nr. 9161 0404



MODEX-AV-HDMI-DVI-IM

Part nr. 9161 0407



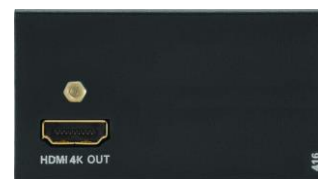
MODEX-AV-HDMI-DVI-4K-IM

Part nr. 9161 0410



MODEX-AV-HDMI-OM

Part nr. 9161 0413



MODEX-AV-HDMI-4K-OM

Part nr. 9161 0416



MODEX-AV-3GSDI-IM

Part nr. 9161 0426



MODEX-AV-DVI-OM

Part nr. 9161 0430



MODEX-AV-DVI-IM

Part nr. 9161 0433

2.5. Interface modules



MODEX-IF-RS232

Part nr. 9161 0712



MODEX-IF-2xRS232

Part nr. 9161 0713



MODEX-IF-RS232-RS422

Part nr. 9161 0714



MODEX-IF-RS232-IR

Part nr. 9161 0715



MODEX-IF-ETH

Part nr. 9161 0718



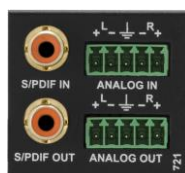
MODEX-IF-AUDIN

Part nr. 9161 0719



MODEX-IF-AUDOUT

Part nr. 9161 0720



MODEX-IF-AUD

Part nr. 9161 0721

2.6. Electrical connections

2.6.1. Fiber optical connectors

MODEX can be ordered with several standard fiber connector types.

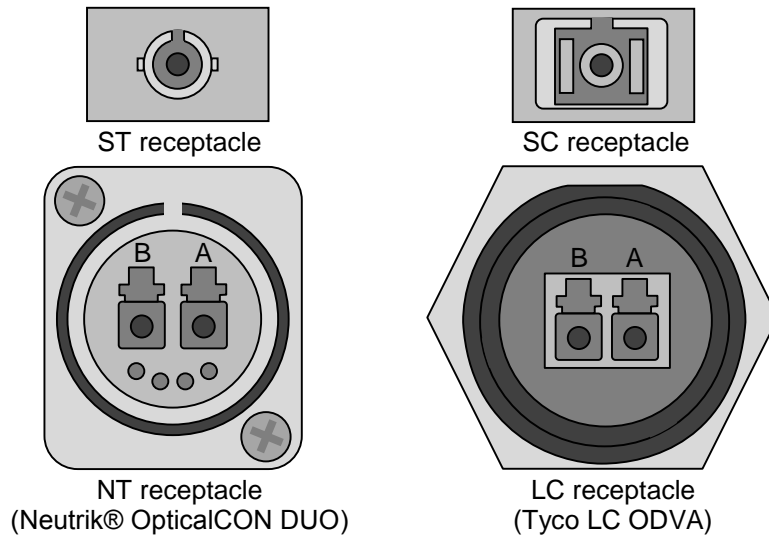
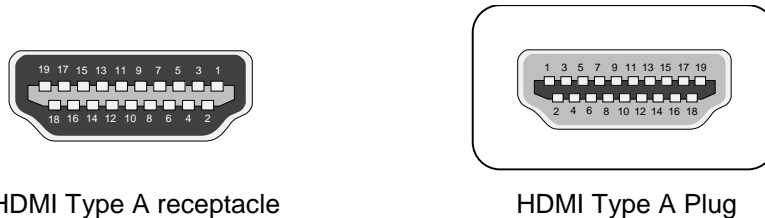


Figure 2-1. Available Fiber optical connectors for MODEX

Neutrik OpticalCON connector (NO2-4FDW type LC duplex) and LC ODVA connector have two fiber channels, *channel A* and *channel B*. Only one channel is used (from *channel A* on transmitter to *channel B* on receiver). The copper pins of the Neutrik connector are not in use.

2.6.2. HDMI inputs and outputs

19-pole HDMI connectors are provided for inputs and outputs.



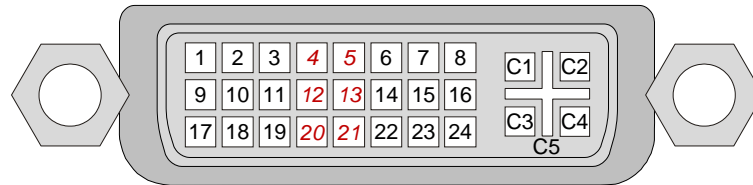
| Pin | Signal | Pin | Signal |
|-----|-------------------|-----|------------------------|
| 1 | TMDS Data2+ | 11 | TMDS Clock Shield |
| 2 | TMDS Data2 Shield | 12 | TMDS Clock– |
| 3 | TMDS Data2– | 13 | CEC |
| 4 | TMDS Data1+ | 14 | Reserved |
| 5 | TMDS Data1 Shield | 15 | SCL |
| 6 | TMDS Data1– | 16 | SDA |
| 7 | TMDS Data0+ | 17 | DDC/CEC/HEC Ground |
| 8 | TMDS Data0 Shield | 18 | +5 V Power (max 50 mA) |
| 9 | TMDS Data0– | 19 | Hot Plug Detect |
| 10 | TMDS Clock+ | | |

Table 2-1. HDMI connector and pin assignments

2.6.3. DVI inputs and outputs

29 pole DVI-I connectors, however internally connected pins vary by interface types. This way, user can plug in any DVI connector, but keep in mind that analog signals (such as VGA or RGBHV) are currently not processed – planned for future developments.

Always use high quality DVI cable for connecting sources and displays. Pay attention to the DVI cable, if dual link signal is to be sent, use only dual link capable DVI cables.

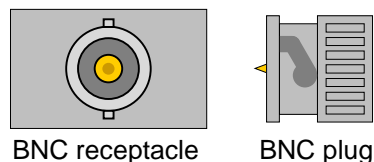


| Pin | Signal | Pin | Signal | Pin | Signal |
|-----|---|-----|---------------------------------|-----|--------------------------------|
| 1 | TMDS Data2- | 9 | TMDS Data1- | 17 | TMDS Data0- |
| 2 | TMDS Data2+ | 10 | TMDS Data1+ | 18 | TMDS Data0+ |
| 3 | TMDS Data2/4 Shield | 11 | TMDS Data1/3 Shield | 19 | TMDS Data0/5 Shield |
| 4 | <i>TMDS Data4⁻¹</i> | 12 | <i>TMDS Data3⁻¹</i> | 20 | <i>TMDS Data5⁻¹</i> |
| 5 | <i>TMDS Data4⁺</i> | 13 | <i>TMDS Data3⁺</i> | 21 | <i>TMDS Data5⁺</i> |
| 6 | DDC Clock | 14 | +5V Power | 22 | TMDS Clock Shield |
| 7 | DDC Data | 15 | GND (for +5V) | 23 | TMDS Clock+ |
| 8 | <i>Analog Vertical Sync²</i> | 16 | Hot Plug Detect | 24 | TMDS Clock- |
| C1 | <i>Analog Red²</i> | C2 | <i>Analog Green²</i> | C3 | <i>Analog Blue²</i> |
| C4 | <i>Analog Horizontal Sync²</i> | C5 | GND | | |

Table 2-2. DVI-I connector pin assignments

2.6.4. BNC connectors (SDI)

Standard BNC receptacle is used for SD/HD/3G-SDI input and outputs.



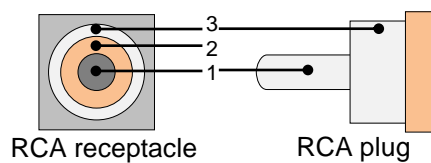
Recommended coax cable type: Belden 1694A

¹ These pins are connected only in MODEX-AV-DVIDL-IM and MODEX-AV-DVIDL-OM modules.

² These pins are only for future developments.

2.6.5. S/PDIF digital audio input and output

Some interface modules have standard RCA receptacles for digital coaxial audio inputs and outputs.



| Nr. | Name |
|-----|------------------------|
| 1 | S/PDIF input or output |
| 2 | Plastic insulator |
| 3 | GND |

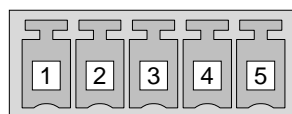
Figure 2-2. S/PDIF connector and pin assignments

Info: Plugs and sockets on consumer equipment are conventionally color-coded by CEA/CEDIA-863-B (ANSI) to aid correct connections. According to the standard Lightware devices are supplied with orange colored RCA connectors for S/PDIF signals.

2.6.6. Symmetrical analog stereo audio

5-pole Phoenix connector is used for symmetrical analog audio. The connector is used on certain interface modules as a configurable input or output. Always check if this connector is configured as an output or input to prevent connecting two outputs together.

Asymmetrical audio signals can be connected as well. For asymmetrical output, connect only + and ground. For asymmetrical input connect + and ground to the source and connect – to the ground.



| Pin nr. | Signal |
|---------|--------|
| 1 | Left+ |
| 2 | Left- |
| 3 | Ground |
| 4 | Right- |
| 5 | Right+ |

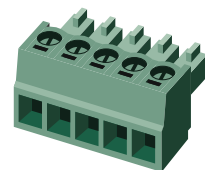


Figure 2-3. Analog input connector pin assignments

Compatible plug type:

Phoenix® Combicon series (3.5mm pitch), type: MC 1.5/5-ST-3.5, order nr. 1840395.

2.6.7. IR connectors

IR Receiver and Transmitter are connected with TRS (Tip, Ring, and Sleeve) connectors. They are also known as (3,5 mm or approx. 1/8") audio jack, phone jack, phone plug or mini-jack plug.



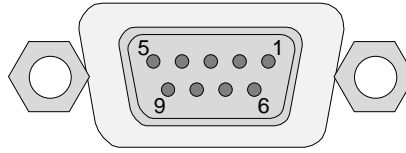
| Receiver – 3-pole-TRS | | Transmitter – 2-pole-TRS | |
|-----------------------|------------|--------------------------|-------------|
| 1 Tip | IR Input - | 1 Tip | IR Output + |
| 2 Ring | GND | 2 Ring | IR Output - |
| 3 Sleeve | IR Input + | 3 Sleeve | IR Output - |

Table 2-3. TRS connector pin assignment for supplied IR accessories

Info: Transmitter's Ring pole is optional. If your IR Transmitter has three pole TRS plug, then the Ring and the Sleeve are the same signal (Output -).

2.6.8. RS-232 / RS-422 port

MODEX can be ordered with interface containing industry standard RS-232 and RS-422 9-pole D-SUB male connector.



| Pin nr. | RS-232 | RS-422 |
|---------|-------------------------------------|-------------------------------------|
| 1 | NC - not connected | RX- data receive complement |
| 2 | RX data receive (input) | RX+ data receive true |
| 3 | TX data transmit (output) | TX+ data transmit true |
| 4 | DTR (Internally connected to Pin 6) | TX- data transmit complement |
| 5 | GND signal ground (shield) | GND signal ground (shield) |
| 6 | DSR (Internally connected to Pin 4) | DSR (Internally connected to Pin 4) |
| 7 | RTS | RTS |
| 8 | CTS | CTS |
| 9 | NC - not connected | NC - not connected |

Table 2-4. D-SUB 9-pole-connector and pin assignments

2.6.9. Ethernet port

MODEX can be remote controlled through Ethernet. The Ethernet port can be connected to a LAN hub, switch or router with a UTP patch cable.

Info: Do not connect more than one port of the MODEX pair to the same LAN to avoid loops.

| | LED1 (green) | LED2 (orange) | Pin nr. | Name | Wire color |
|--------------|-------------------|------------------|---------|----------|---------------|
| OFF | no link / 10 Mbps | no activity | 1 | TX + | Green stripe |
| ON | 100 Mbps | N/A | 2 | TX - | Green |
| Blink | N/A | activity | 3 | RX + | Orange stripe |
| | | | 4 | Not used | Blue |
| | | | 5 | Not used | Blue stripe |
| | | | 6 | RX - | Orange |
| | | | 7 | Not used | Brown stripe |
| | | | 8 | Not used | Brown |

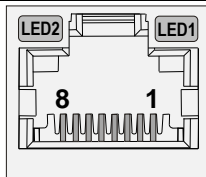


Table 2-5. RJ45 connector and Ethernet pin connections

2.6.10. Neutrik power connector

MODEX-CON-OPTS-NT-PCN and MODEX-CON-OPTM-NT-PCN media connectors are assembled with special Neutrik power connector, NAC3MPA-1 (Power In). It ensures a very rugged solution in combination with a locking device in order to guarantee a safe power connection.

Important! *PowerCON is a connector without breaking capacity; it should not be connected or disconnected under load or live!*

After plugging it in, turn the plug clockwise; to disconnect, first pull the latch backward, turn the plug counterclockwise and unplug the connector.

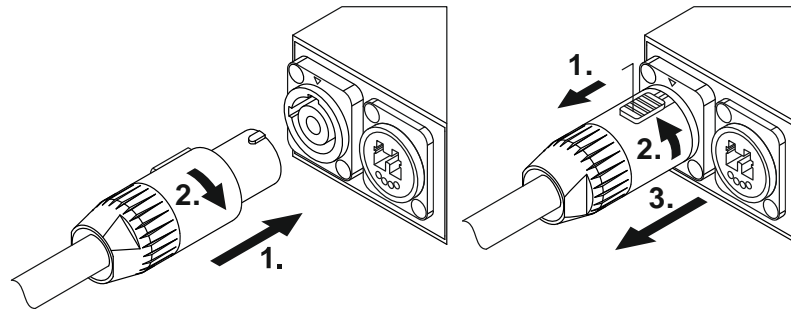


Figure 2-4. Locking and unlocking Neutrik power connector

Supplied power cable

The cable is assembled with NAC3FCA Neutrik power connector (Power In) with white chuck that fits for thin cables (diameter between 6.0 and 11.0 mm). A black-colored chuck is also supplied that fits for thick cables (diameter between 9.5 and 15.0 mm).

Assembling

Important! *Cable assembling can be only done by qualified person!*

If the cable needs to be replaced, the following steps help when assembling:

Step 1. Put bushing and chuck onto the cable.

Step 2. Prepare cable.

Step 3. Insert the wire into the terminals and fasten the clamping device by a flat screw driver.

Step 4. Push insert and chuck into housing (pay attention to the guiding keyway!)

Step 5. Fasten bushing by means of a fork wrench 3/4", min. Torque 2.5 Nm.

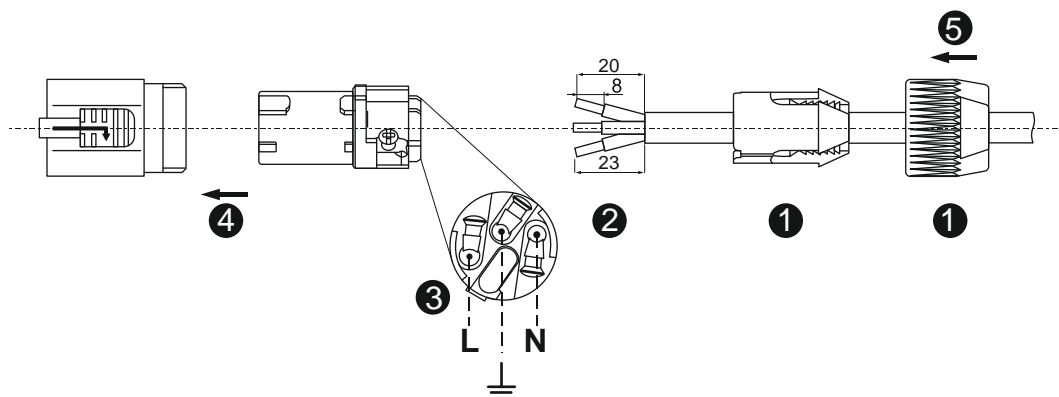


Figure 2-5. Neutrik power connector assembling

3. Technologies

3.1. Understanding EDID

3.1.1. Basics

EDID stands for Extended Display Identification Data. Simply put, EDID is the passport of display devices (monitors, TV sets, projectors). It contains information about the display's capabilities, such as supported resolutions, refresh rates (these are called Detailed Timings), the type and manufacturer of the display device, etc.

After connecting a DVI source to a DVI display, the source reads out the EDID to determine the resolution and refresh rate of the image to be transmitted.

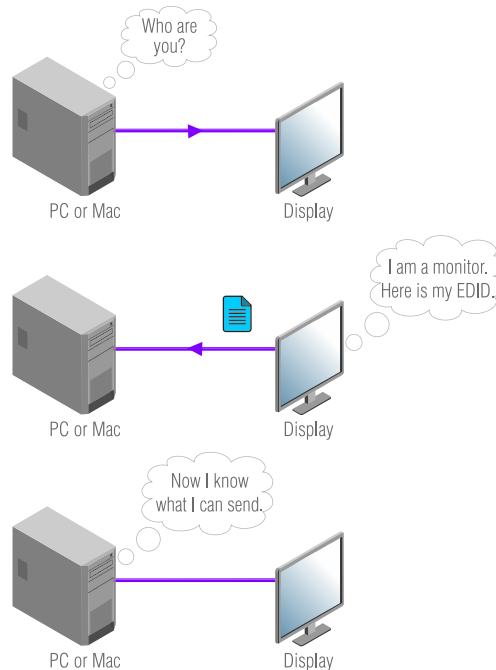


Figure 3-1. EDID communication

Most DVI computer displays have 128-byte long EDID structure. However, Digital Televisions and HDMI capable displays may have another 128 bytes, which is called E-EDID and defined by CEA (Consumer Electronics Association). This extension contains information about additional Detailed Timings, audio capabilities, speaker allocation and HDMI capabilities. It is important to know, that all HDMI capable devices must have CEA extension, but not all devices are HDMI capable which have the extension.

3.1.2. Common problems related to EDID

Problem: „I have changed to a different EDID on MODEX-OPTS-TX to have a different resolution but nothing happens.”

Solution: Some graphics cards and video sources read out the EDID only after power-up and later they don't sense that EDID has been changed. You need to restart your source to make it read out the EDID again.

Problem: „I have a MODEX-OPTS-TX and I'm using a Lightware factory preset EDID. I would like to be able to choose from different resolutions, but my source allows only one resolution.”

Solution: Most Lightware factory preset EDIDs allow only one resolution, forcing the sources to output only that particular signal. You need to select the Universal EDID that supports all common VESA resolutions; see the factory EDID list in section [4.3.2](#) on page [24](#).

3.2. Advanced EDID management

Each DVI sink (e.g. monitors, projectors, plasma displays, and switcher inputs) must support the EDID data structure. Source BIOS and operating systems are likely to query the sink using DDC2B protocol to determine what pixel formats and interface are supported. DVI standard makes use of EDID data structure for the identification of the monitor type and capabilities. Most DVI sources (VGA cards, set top boxes, etc.) will output DVI signal after accepting the connected sink's EDID information. In case of EDID readout failure or missing EDID, the source will not output DVI video signal.

MODEX transmitters provide Lightware's Advanced EDID Management function that helps system integration. The transmitter's built-in EDID memory stores and emulates more than 100 EDID data (factory presets and user memory, the exact number depends on the firmware) plus the monitor's EDID that is connected to the receiver's output connector. MODEX stores the EDID of the attached monitor or projector in a non-volatile memory. This way the EDID from a monitor is available when the monitor is unplugged, or switched off.

The EDID emulated on the DVI input can be copied from the transmitter's memory (static EDID emulation), or from the last attached monitors memory (dynamic EDID emulation). For example, the transmitter can be set up to emulate a device, which is connected to the receiver's DVI output. In this case the EDID automatically changes, if the monitor is replaced with another display device (as long as it has a valid EDID).

Advanced EDID management can be controlled by the front panel's control buttons and via the built-in webpage.

Info: The user is not required to disconnect the DVI cable to change an EDID as opposed to other manufacturer's products. EDID can be changed even if source is connected to the input and powered ON.

Info: When EDID has been changed, the transmitter toggles the HOTPLUG signal for 2 seconds. Some sources do not observe this signal, so in this case the change is not recognized by the source. In such cases the source device must be restarted or powered OFF and ON again.

3.3. HDCP management

Lightware Visual Engineering is a legal HDCP adopter, and has developed several functions that helps to solve HDCP related problems. Complex AV systems often have both HDCP and non-HDCP components. MODEX extenders allow to transmit HDCP encrypted and unencrypted signals. The devices will be still HDCP compliant as they will never output an encrypted signal to a non-HDCP compliant display device. If an encrypted signal should be switched to a non-compliant output, it will show a red screen alert or will be muted.

3.3.1. Protected and unprotected content

Many video sources send HDCP protected signal if they detect that the sink is HDCP capable – even if the content is not copyrighted. This can cause trouble if a HDCP capable device (e.g. an extender-pair) is connected between the source and the display. In this case the content can't be viewed on non-HDCP capable displays and interfaces like event controllers.

Rental and staging technicians often complain about Apple laptops, who always send HDCP encrypted signals if the receiver device (display, matrix router, etc.) reports HDCP compliancy. However HDCP encryption is not required all the time (e.g. computer desktop image) MacBook and MacBook Pro still do that.

To avoid unnecessary HDCP encryption, Lightware introduced the HDCP enabling/disabling function: the HDCP capability can be disabled on the extenders. If HDCP is disabled, the connected source will detect that the sink is not HDCP capable, and turn off authentication. The source will not be able to communicate with any of the devices (displays, repeaters, etc.) that are connected to the receiver's output, therefore it could not see if they are HDCP capable or not.

3.3.2. Real life examples

HDCP-compliant sink

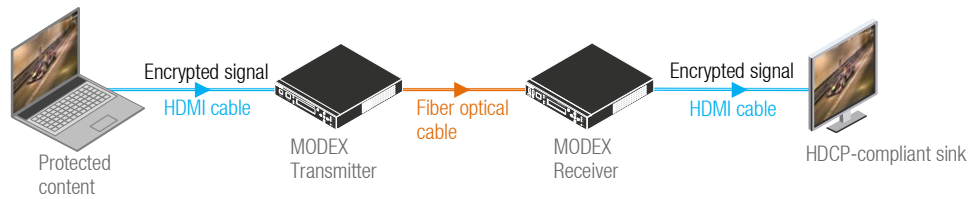


Figure 3-2. HDCP-compliant sink (HDMI/DVI)

All devices are HDCP-compliant, no special setting is required, both protected and unprotected content is transmitted and displayed on the sink.

Non-HDCP-compliant sink (HDMI/DVI) 1.

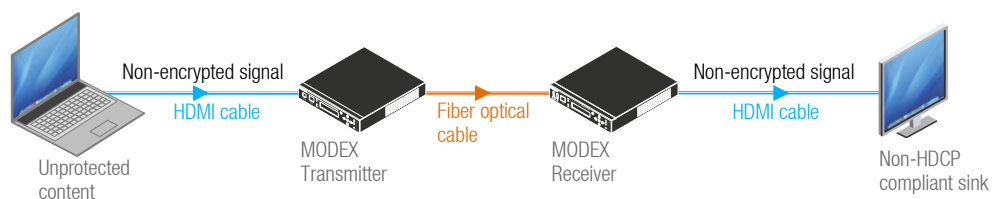


Figure 3-3. Non-HDCP compliant sink displaying unprotected content

Non-HDCP compliant display device is connected to the receiver. Some sources (e.g. computers) always send HDCP encrypted signals if the receiver device reports HDCP compliancy, however HDCP encryption is not required all the time (e.g. computer desktop image). If HDCP is enabled in the extenders, the image will not be displayed.

On MODEX extenders HDCP mode can be set to *Auto*. In this case the transmitted signal will not be encrypted if the content is not protected. Thus non-HDCP compliant sinks will display non-encrypted signal.

Non-HDCP-compliant sink (HDMI/DVI) 2.

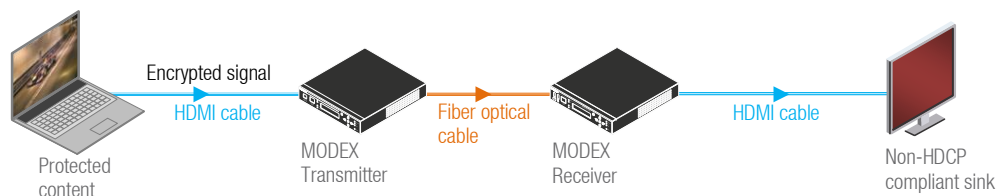


Figure 3-4. Non-HDCP compliant sink and protected content

The layout is the same as in previous case: non-HDCP compliant display device is connected to the receiver. Now the difference is that the content is protected, thus the source is sending encrypted signal. In this case the extenders' HDCP setting has no effect: the source sends encrypted signal, since the content is protected. The display device will show blank red, muted screen or pop up an error message that the sink is not HDCP-compliant. The solution is to replace the display device to a HDCP-capable one.

4. MODEX concept

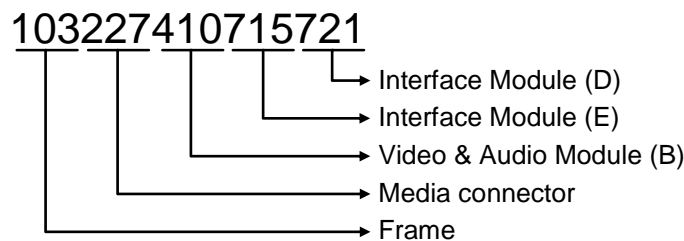
4.1. Module code sequence

Each MODEX unit has a 15-character-long code sequence which identifies the modules built in the frame. The code sequence consists of 5x3 blocks of characters. The 3-character-long blocks are the last three characters of a module's part code (this code is also painted on the module/frame).

The following example represents the structure of the code sequence:



The module code – that is displayed in idle state – of above MODEX unit is:



| | | |
|-------------|--|--------------------------|
| 103: | (9161 01 03) MODEX-OPTS-TX | Frame |
| 227: | (9161 02 27) MODEX-CON-NT-OPTS | Media connector |
| 410: | (9161 04 10) MODEX-AV-HDMI-DVI-4K-IM | Video & Audio Module (B) |
| 715: | (9161 07 15) MODEX-IF-RS232-IR | Interface Module (E) |
| 721: | (9161 07 21) MODEX-IF-AUD | Interface Module (D) |

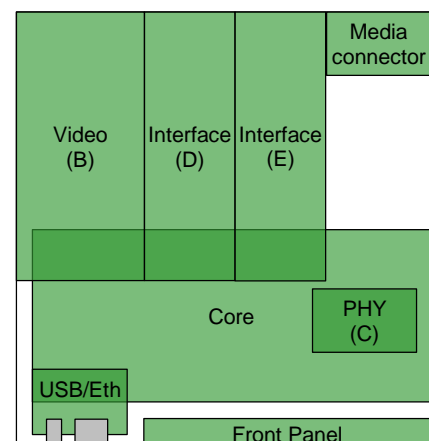
Info: The order of the modules and codes are determined by Lightware.

4.2. Module layout

The layout of the modules is fixed so as the order of the module codes. *B*, *D* and *E* letters determine the module positions which help to identify them in LW3 protocol.

C means the physical module (PHY), which is integrated into the Core module in MODEX-OPT extenders.

The letters are also displayed in the built-in website in the *Settings* menu, *Status* submenu, see section [7.8.3](#) on page [54](#), and *Lock* submenu, see in section [7.8.7](#) on page [56](#).



4.3. EDID memory (transmitter)¹

EDID memory is non-volatile and consists of four blocks, each for different purposes:

- Factory preset EDIDs
- User-saved EDIDs
- Dynamic EDID (EDID of last connected sink on the output port)
- Emulated EDIDs (EDID currently emulated on a specific input port)

EDIDs are numbered from 1 in each block. They can be referred as the first letter of the block name and the number of the desired EDID. This way F02 refers to the second factory preset EDID.

Dynamic and emulated EDID blocks' size depends on the A/V modules. EDID memory structure is the following:

- F01..F119..... Factory Preset EDIDs
- U01..U31 User programmable memories
- Dxx Last attached monitor's EDID (output)
- Exx Emulated EDID (input)

Dynamic, factory and user EDIDs can be switched and emulated at the input(s).

Info: Factory EDIDs (Fxx) are factory preprogrammed and cannot be modified. These are the most commonly used resolutions.

Info: MODEX can handle both 128 Byte EDID and 256 Byte extended EDID structures.

Info: Attached monitor's EDID is stored automatically, until a new monitor is attached to that particular output. In case of powering the unit off, last attached monitor's EDID remains in non-volatile memory even if the monitor is disconnected.

4.3.1. EDID types

Most of the factory preset EDIDs include only one resolution. This is to force the connected source to give a signal with the needed resolution. However there are Universal EDIDs as well which allow many resolutions.

Factory EDIDs are divided into groups regarding their type. Some EDIDs support DVI only, some support HDMI and some are for analog VGA signals. Also there are EDIDs for Dual Link DVI resolutions.

DVI EDIDs does not support audio. Universal DVI EDID indicates support for many PC (VESA) resolutions.

HDMI EDIDs support embedded audio. These EDIDs have PCM stereo audio format enabled. To allow other audio formats like Dolby and DTS, special EDIDs have to be used. There are three Universal HDMI EDIDs which include the same resolutions but support different capabilities:

| EDID | PCM audio | other audio | deep color |
|--------------------|-----------|-------------|------------|
| Universal_HDMI_PCM | yes | no | no |
| Universal_HDMI_ALL | yes | yes | no |
| Universal_HDMI_DC | yes | yes | yes |

Table 4-1. Universal HDMI EDIDs

Info: Analog EDIDs are for future developments.

Dual Link DVI EDIDs does not support audio. Use only for Dual Link ports.

¹ The exact EDID memory size depends on the firmware and the installed A/V modules.

4.3.2. Factory EDID list

| Mem. | Resolution | Type | Mem. | Resolution | Type |
|------|------------------------|------|------|------------------------|------|
| F01 | 640 x 480 @ 59.95 Hz | D | F61 | 1280 x 768 @ 59.92 Hz | A |
| F02 | 848 x 480 @ 60.0 Hz | D | F62 | 1280 x 768 @ 75.0 Hz | A |
| F03 | 800 x 600 @ 60.30 Hz | D | F63 | 1360 x 768 @ 60.1 Hz | A |
| F04 | 1024 x 768 @ 60.0 Hz | D | F64 | 1364 x 768 @ 50.0 Hz | A |
| F05 | 1280 x 768 @ 50.0 Hz | D | F65 | 1364 x 768 @ 59.93 Hz | A |
| F06 | 1280 x 768 @ 59.92 Hz | D | F66 | 1364 x 768 @ 74.98 Hz | A |
| F07 | 1280 x 768 @ 75.0 Hz | D | F67 | 1280 x 1024 @ 50.0 Hz | A |
| F08 | 1360 x 768 @ 60.1 Hz | D | F68 | 1280 x 1024 @ 60.1 Hz | A |
| F09 | 1280 x 1024 @ 50.0 Hz | D | F69 | 1366 x 1024 @ 59.99 Hz | A |
| F10 | 1280 x 1024 @ 60.1 Hz | D | F70 | 1400 x 1050 @ 49.99 Hz | A |
| F11 | 1280 x 1024 @ 75.1 Hz | D | F71 | 1400 x 1050 @ 59.99 Hz | A |
| F12 | 1400 x 1050 @ 49.99 Hz | D | F72 | 1400 x 1050 @ 75.0 Hz | A |
| F13 | 1400 x 1050 @ 59.99 Hz | D | F73 | 1920 x 540 @ 50.0 Hz | A |
| F14 | 1400 x 1050 @ 75.0 Hz | D | F74 | 1920 x 540 @ 59.98 Hz | A |
| F15 | 1680 x 1050 @ 59.99 Hz | D | F75 | 1920 x 1080 @ 50.0 Hz | A |
| F16 | 1920 x 1080 @ 50.0 Hz | D | F76 | 1920 x 1080 @ 60.0 Hz | A |
| F17 | 1920 x 1080 @ 60.0 Hz | D | F77 | 1600 x 1200 @ 50.0 Hz | A |
| F18 | 2048 x 1080 @ 50.0 Hz | D | F78 | 1600 x 1200 @ 60.0 Hz | A |
| F19 | 2048 x 1080 @ 59.99 Hz | D | F79 | 1920 x 1200 @ 59.55 Hz | A |
| F20 | 1600 x 1200 @ 50.0 Hz | D | F80 | 1920 x 1200 @ 50.0 Hz | A |
| F21 | 1600 x 1200 @ 60.0 Hz | D | F81 | Reserved | |
| F22 | 1920 x 1200 @ 50.0 Hz | D | F82 | Reserved | |
| F23 | 1920 x 1200 @ 59.55 Hz | D | F83 | Reserved | |
| F24 | 2048 x 1200 @ 59.95 Hz | D | F84 | Reserved | |
| F25 | Reserved | | F85 | Reserved | |
| F26 | Reserved | | F86 | Reserved | |
| F27 | Reserved | | F87 | Reserved | |
| F28 | Reserved | | F88 | Reserved | |
| F29 | Universal DVI | D | F89 | Univ Analog | A |
| F30 | 1440 x 240i @ 60.3 Hz | H | F90 | 1920 x 2160 @ 59.98 Hz | DL |
| F31 | 1440 x 288i @ 50.6 Hz | H | F91 | 1024 x 2400 @ 60.1 Hz | DL |
| F32 | 640 x 480 @ 59.94 Hz | H | F92 | 1920 x 2400 @ 59.97 Hz | DL |
| F33 | 720 x 480 @ 59.92 Hz | H | F93 | 2048 x 2400 @ 59.97 Hz | DL |
| F34 | 720 x 576 @ 50.0 Hz | H | F94 | 2048 x 1536 @ 59.99 Hz | DL |
| F35 | 1280 x 720 @ 50.0 Hz | H | F95 | 2048 x 1536 @ 74.99 Hz | DL |
| F36 | 1280 x 720 @ 60.0 Hz | H | F96 | 2560 x 1600 @ 59.85 Hz | DL |
| F37 | 1920 x 540i @ 50.3 Hz | H | F97 | 3840 x 2400 @ 23.99 Hz | DL |
| F38 | 1920 x 540i @ 50.0 Hz | H | F98 | 1280 x 720 @ 60.0 Hz | H3D |
| F39 | 1920 x 540i @ 59.98 Hz | H | F99 | 1920 x 1080 @ 60.0 Hz | H3D |
| F40 | 1920 x 540i @ 60.5 Hz | H | F100 | 1024 x 768 @ 60.0 Hz | H |
| F41 | 1920 x 1080 @ 24.0 Hz | H | F101 | 1280 x 1024 @ 50.0 Hz | H |
| F42 | 1920 x 1080 @ 24.99 Hz | H | F102 | 1280 x 1024 @ 60.1 Hz | H |
| F43 | 1920 x 1080 @ 30.0 Hz | H | F103 | 1280 x 1024 @ 75.1 Hz | H |
| F44 | 1920 x 1080 @ 50.0 Hz | H | F104 | 1600 x 1200 @ 50.0 Hz | H |
| F45 | 1920 x 1080 @ 59.93 Hz | H | F105 | 1600 x 1200 @ 60.0 Hz | H |
| F46 | 1920 x 1080 @ 60.0 Hz | H | F106 | 1920 x 1200 @ 59.55 Hz | H |
| F47 | Universal HDMI_PCM | H | F107 | 2560 x 1440 @ 59.94 Hz | H |
| F48 | Universal HDMI_ALL | H | F108 | 2560 x 1600 @ 59.85 Hz | H |
| F49 | Universal HDMI_DC | H | F109 | 3840 x 2400 @ 23.99 Hz | H |
| F50 | 720 x 480 @ 30.1 Hz | A | F110 | 3840 x 2160 @ 24.0 Hz | H |
| F51 | 720 x 576 @ 25.3 Hz | A | F111 | 3840 x 2160 @ 25.0 Hz | H |
| F52 | 640 x 480 @ 60.0 Hz | A | F112 | 3840 x 2160 @ 30.0 Hz | H |
| F53 | 640 x 480 @ 75.0 Hz | A | F113 | Reserved | |
| F54 | 800 x 600 @ 50.0 Hz | A | F114 | Reserved | |
| F55 | 800 x 600 @ 60.3 Hz | A | F115 | Reserved | |
| F56 | 800 x 600 @ 74.99 Hz | A | F116 | Reserved | |
| F57 | 1024 x 768 @ 49.98 Hz | A | F117 | Reserved | |
| F58 | 1024 x 768 @ 60.0 Hz | A | F118 | Universal_4K_PCM | H4K |
| F59 | 1024 x 768 @ 75.2 Hz | A | F119 | Universal_4K_ALL | H4K |
| F60 | 1280 x 768 @ 50.0 Hz | A | | | |

EDID types: D=DVI EDID; H=HDMI EDID; A=Analog EDID; DL=Dual-Link DVI EDID;
H3D=HDMI EDID with 3D support; H4K: HDMI EDID with 4K resolution support

Table 4-2. Factory preset EDID list

4.4. USB K+M

MODEX devices are able to extend two USB 1.1 and/or USB 2.0 devices from the transmitter to the receiver that are compatible and in line with USB HID standard. Typical supported USB devices are:

- USB mouse and keyboard,
- Smart Card (reader).

Typical application is when a computer located at the transmitter is controlled at receiver's side by the connected keyboard and mouse via USB. Certain touch monitors fulfill the USB HID standard, which can also be connected.

Below listed devices have been tested and found compatible by Lightware:

- Touch Revolution K17A-0101-A0 (VID:0x0EEf PID:0x72C4),
- Dell ST2220T (VID:0x1FD2 PID:0x0064),
- LG 23ET83V (VID:0x0457 PID:0x1030) – currently one point touch is supported,
- ZYTRONIC (VID:0x14C8 PID:0x0005) and
- Wacom intous5 tablet.

5. Installation

5.1. Connecting devices

When building an electronic system, make sure that all devices are powered down before connecting them. Powered on devices may have dangerous voltage levels that can damage sensitive electronic circuits. After the system is complete, connect the power cables to the extenders and to the power outlet; the units are immediately powered ON.

Info: Do not connect more than one port of a MODEX to the same LAN to avoid loops. In the same way; if a MODEX transmitter and a receiver are linked by fiber optical cable, do not connect both to the same LAN, only one of them.

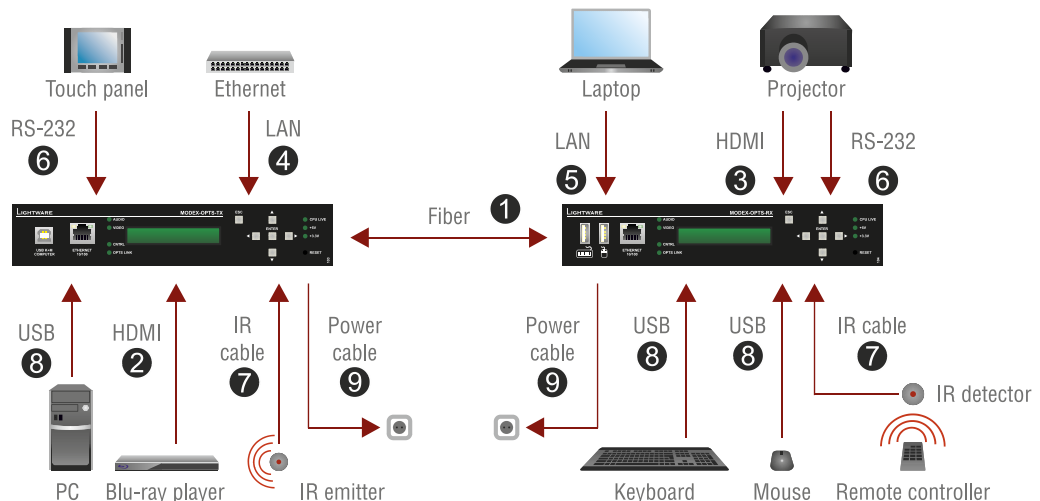




Figure 5-1. Connecting devices

- Step 1.** Connect the transmitter and the receiver by a multi- or single mode fiber cable. Connect channel A on transmitter to channel B on receiver.
- Step 2.** Connect a DVI or HDMI source (e.g. computer) to the transmitter's DVI or HDMI INPUT connector.
- Step 3.** Connect a DVI or HDMI sink (e.g. projector) to the receiver's DVI or HDMI output.
- Step 4.** Optionally connect the transmitter or the receiver to a Local Area Network in order to control the devices by the built-in Web page. More information about establishing the connection can be found in section [7](#) on page [36](#).
- Step 5.** Optionally connect Ethernet devices¹ (e.g. switch, laptop, computer etc.) to the available RJ45 connector(s) of the extender(s). All connected devices will work as if they are connected to the same network.
- Step 6.** Optionally for RS-232 extension¹:
 - Connect a controller unit (e.g. Touch panel) to the RS-232 port of the transmitter with a null modem serial cable.
 - Connect a controlled device (e.g. Projector) to the RS-232 port of the receiver with a regular serial cable.
- Step 7.** Optionally for Infra-Red extension¹:
 - Connect the supplied IR emitter to the IR OUT port of the transmitter or receiver.
 - Connect the supplied IR detector to the IR IN port of the transmitter or receiver.

¹ Mentioned devices are examples and can be connected to either transmitter or receiver.

Step 8. Optionally for USB HID extension¹:

- Connect at least one USB HID device to the receiver. Use the keyboard  and the mouse  labelled USB-A connectors.
- Connect the transmitter to the computer by the USB-B cable.

Step 9. Power on the devices using the power cables.

5.2. Serial devices

5.2.1. General information about serial communication

There are two kind of devices in general serial communication from our aspect:

Data Terminal Equipment (DTE)

DTE is an end-instrument that converts user information into signals or reconverts received signals. Typical DTE devices: computers, LCD touch panels, control systems.

Data Circuit-terminating Equipment (DCE)

DCE is device that sits between the DTE and a data transmission circuit. It also called data communication equipment and data carrier equipment. Typical DCE devices: projectors, industrial monitors and amplifiers.

Among others the pin assignment is different between DTE and DCE and different type of serial cables have to be used between the serial devices.

| | DTE | DCE | | DTE | DCE |
|------|-----|-----|-----|------------|------------|
| Pin2 | RD | TD | DTE | Null-modem | Straight |
| Pin3 | TD | RD | DCE | Straight | Null-modem |

Legend: RD=Received data; TD=Transmitted data

Table 5-1. Pin assignments and applicable serial cables

Serial cable types

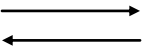

| Straight serial cable | Null-modem serial cable |
|---|---|
|  |  |
| Straight pin-outs on both ends | Straight pin-out at the one end and cross pin-out at the other end (interchange lines of TX and RX) |

Table 5-2. Serial cable types

5.2.2. Example connection diagrams

Following cases are examples; devices may have different receptacles and pin-outs.

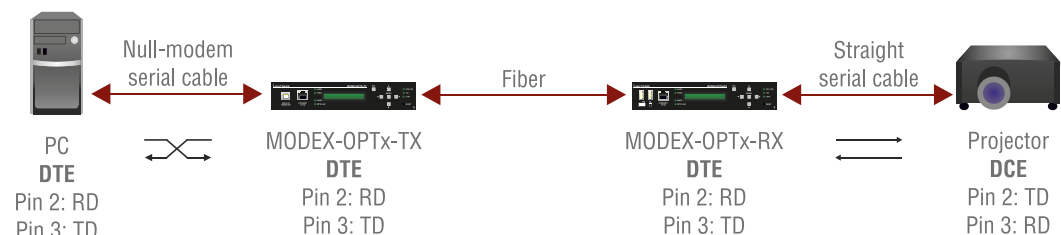


Figure 5-2. Extending RS-232 between computer (DTE) and projector (DCE)

¹ Mentioned devices are examples and can be connected to either transmitter or receiver

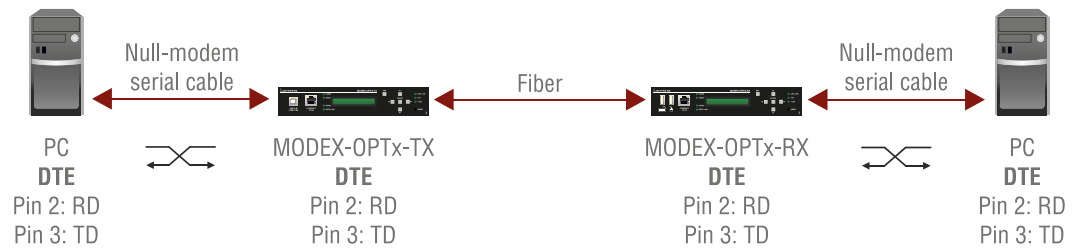


Figure 5-3. Extending RS-232 between computer (DTE) and computer (DTE)

5.3. Mounting options

Devices can be mounted in several ways, depending on the application. Besides using with rack shelf, a mounting bracket is available which offers easy mounting on truss systems with standard clamps or using the unit built into furniture.

5.3.1. Rack shelf mounting (with 1U high rack shelf)

- Step 1.** Turn the unit upside down.
- Step 2.** Put the rack shelf upside down on the unit, and position it to get the mounting holes aligned.
- Step 3.** Fasten the unit on the rack shelf with the provided screws.
- Step 4.** Mount the rack shelf in the rack.



5.3.2. Truss mounting (with Mounting bracket V2)

- Step 1.** Fasten the mounting bracket on the side of the unit with the provided screws.
- Step 2.** Use a bolt to attach a standard clamp. (The clamp is not supplied with the device.)
- Step 3.** Mount the unit on the truss with the clamp.



5.3.3. Through furniture mounting (with Mounting bracket V2)

To get a good result, the thickness of the board should not exceed 25 millimeters.

- Step 1.** Cut a suitable hole in the board.
- Step 2.** Attach the mounting bracket on the side of the unit with the provided screws.
- Step 3.** Mount the unit on the board.
- Step 4.** Loosen the screws a little on the bracket and adjust the unit to line up with the front of the board.



6. Front panel operations

6.1. Front panel menu

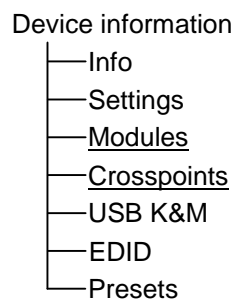
The extender has an LCD on the front panel showing the built-in front panel menu. This can be used to change basic settings or display different information about the modules.

Navigation

Front panel LCD has 2 lines and 16 characters in each line. The name of the menu item is always displayed in the first line. If no button is pressed for 10 minutes, LCD returns to its idle state and Device information is shown.

| Button | Function |
|------------|---|
| ▲ (up) | Toggle between menu items |
| ▼ (down) | |
| ◀ (left) | Move the cursor or step back to previous menu |
| ▶ (right) | Move the cursor |
| ◆ (enter) | Execute changes or enter submenu |
| ◻ (escape) | Step back to previous menu |

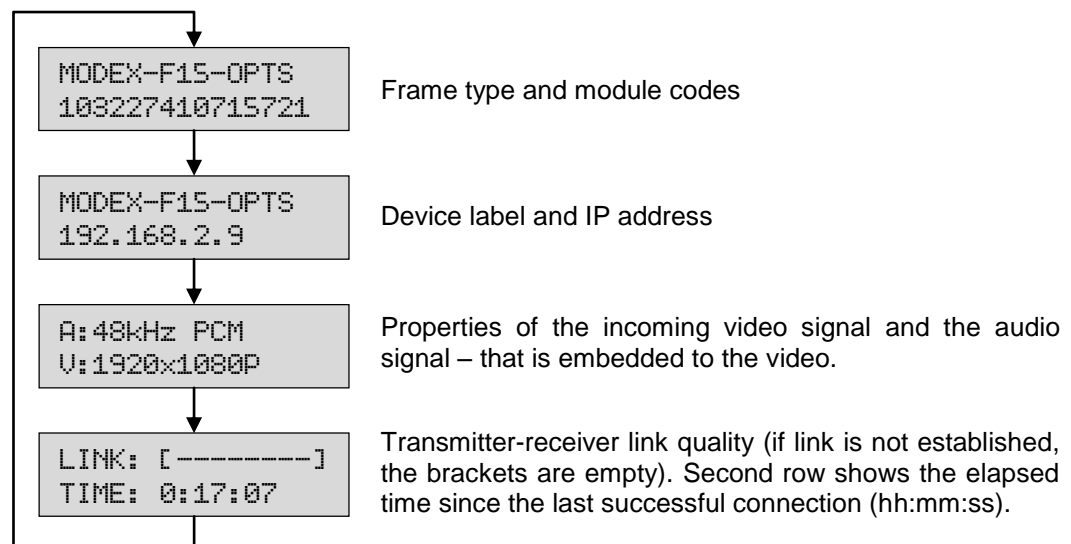
Menu structure



Info: The content of the underlined menu items depend on the installed modules.

Idle state (Device information)

If no button is pressed for 10 minutes or the user navigates out from the menu by the escape ◻ and/or the left ◀ button, LCD gets into idle state. Front panel menu displays the following information in idle state:



Locking

Modules can be locked by using the built-in website. Front panel menu can be locked as follows:

- **Lock LCD home screen:** The whole screen is locked, no front panel operations can be done, front panel buttons are disabled, Device information is displayed.
- **Disable setup from LCD menu:** Front panel operations are enabled, but settings cannot be changed, a closed padlock sign is displayed.

```
IP Address: ...
192.168.002.20
```

Info: The locking/unlocking can be switched from the built-in website, see more information in section [7.8.7](#) on page [56](#).

6.2. Info menu

The Info menu displays basic information about the unit as follows:

- MCU Firmware version
- FPGA Firmware version
- Web content version
- Supply A (the power supply unit)
- Supply B (not in use, reserved for future developments)
- Temperature – measured on the core module. If the temperature is above the Overheat limit, the speaker sounds, the unit reboots and the event is logged.


6.3. Settings menu

6.3.1. Network settings



If the extender is connected to an Ethernet Network, the settings are available in this submenu.

Info: If you change more settings in Network submenu, it is not necessary to restart the device after every step. Reboot after setting all necessary parameters is enough.

Setting the IP address

Step 1. Navigate to Settings / Network Settings / IP Address submenu and press the enter  button.

```
Network Settings
IP Address
```

Step 2. Use left  and right  buttons to place the cursor to the desired number.

```
IP Address: ...
192.168.002.20
```


Step 3. Set the numbers by the up  and down  buttons.

Step 4. Press the enter  button to save changes.



```
Restart now?
ENTER=Yes ESC=No
```

Step 5. Press the enter  button to restart device (recommended).

Setting the Subnet mask

Step 1. Navigate to Settings / Network Settings / Subnet mask submenu and press the enter  button.

```
Network Settings
Subnet mask
```

Step 2. Use left  and right  buttons to place the cursor to the desired number.

```
Subnet mask: ...
255.255.255.00
```








Step 3. Set the numbers by the up  and down  buttons.

Step 4. Press the enter  button to save changes.

```
Restart now?
ENTER=Yes ESC=No
```

Step 5. Press the enter  button to restart (recommended).

Setting the Static gateway

- Step 1. Navigate to Settings / Network Settings / Static gateway submenu, press the enter  button.
- Step 2. Use left  and right  buttons to place the cursor to the desired number.
- Step 3. Set the numbers by the up  and down  buttons.
- Step 4. Press the enter  button to save changes.
- Step 5. Press the enter  button to restart device (recommended).

```

*Network Setting*
  |--Static Gateway*
  
```








```

*Static Gateway*
  192.168.000.0#
  
```

```

Restart now?
ENTER=Yes ESC=No
  
```

Setting the Port number

- Step 1. Navigate to Settings / Network Settings / Port Number submenu and press the enter  button.
- Step 2. Use left  and right  buttons to place the cursor to the desired number.
- Step 3. Set the numbers by the up  and down  buttons.
- Step 4. Press the enter  button to save changes.
- Step 5. Press the enter  button to restart device (recommended).

```

*Network Setting*
  |--Port Number *
  
```






```

*Port number:  *
  06107        #
  
```

```

Restart now?
ENTER=Yes ESC=No
  
```

DHCP setting

- Step 1. Navigate to Settings / Network Settings / DHCP submenu and press the enter  button.
- Step 2. Use the up  and down  buttons to toggle between Enabled and Disabled settings.
- Step 3. Press the enter  button to save changes.
- Step 4. Press the enter  button to restart device (recommended).

```

*Network Setting*
  |--DHCP        *
  
```

```




*DHCP:         *
  Disabled      #
  
```

```

Restart now?
ENTER=Yes ESC=No
  
```

6.3.2. System settings

Resetting the device

- Step 1. Navigate to Settings / Reset submenu and press the enter  button.
- Step 2. Press the enter  button to restart device or the escape  button to cancel.
- Step 3. The extender is immediately restarted.

```



*System
  |--Reset      *
  
```

```

Restart Device?
ENTER=Yes ESC=No
  
```

Enter bootloader mode

Firmware upgrade of the device can be executed only in Bootload mode. If the working mode of the device is not switched to bootload mode automatically, the mode can be also switched manually.

- Step 1. Navigate to Settings / Enter bootloader submenu and press the enter  button.
- Step 2. Press the enter  button to switch to Bootload mode.
- Step 3. LCD will turn to dark. (The device can be switched to normal operation mode by pressing the reset button or turning it off and on again.)

```

*System
  |--Enter bootlo*
  
```




```

Enter Bootload?
ENTER=Yes ESC=No
  
```

```

-----
  
```

Loading factory defaults

- Step 1.** Navigate to Settings / Fact. defaults submenu and press the enter  button.
- Step 2.** Press the enter  button to load factory defaults or the escape  button to cancel.
- Step 3.** The device is restarted; factory default settings and parameters are set. See the list about the details in section [10.5](#) on page [87](#).

```
System
└─Fact. default
```

```
Fact. defaults?
ENTER=Yes ESC=No
```

6.4. Modules menu

This menu contains information and certain settings of the modules. The menu shows only the installed modules. Each module contains two submenus:

- Info: Contains basic information about the module: Part number, Hardware version and Serial number.
- Settings: Different module by module (see the following sections).

6.4.1. MODEX-PH-OPTS

Info

The followings are listed about core module – besides basic information:

- Firmware ID: Firmware version of the integrated optical module.
- Link quality: If the Link measurement is enabled in the Settings submenu, link quality between transmitter and receiver is displayed in brackets; if the link is not established, the brackets are empty. This is also shown in idle state; for more information see section [6.1](#) on page [29](#).
- Link errors: Number of Link errors is shown in the other submenu, which means the occurrences of link problems (e.g. unsure connection) between the extenders. This is tracked only when Link measurement is enabled.

Settings

- Link measurement: The link quality between transmitter and receiver can be checked when Link measurement option is enabled in this submenu. Link quality and Link errors are displayed in the Info submenu.

6.4.2. MODEX-AV-HDMI-OM and MODEX-AV-HDMI14-OM

Settings

- Video: The following parameters of the output video port can be set:
 - HDMI mode: Auto / DVI / HDMI 24bit / HDMI 30 bit / HDMI 36 bit
 - Color space: Auto / RGB / YUV 4:4:4 / YUV 4:2:2
 - HDCP mode: Auto / Always
When the HDCP mode is set to Always, the signal on the output is encrypted regardless of the incoming signal. When the mode is set to Auto, the output is encrypted only if the content is protected.
 - Color range: Auto / Compress / Expand
Some sources may send the video signal with different color range. If the black or white level seems to be incorrect in the picture try to set this parameter to compress or expand the color range.

Info: Changed settings are saved immediately when selecting by the buttons.

6.4.3. MODEX-AV-HDMI-DVI-IM and MODEX-AV-HDMI-DVI-4K-IM

Settings

- Input port: Active video input port can be selected by this setting (DVI or HDMI).

Step 1. Select the desired port by the up ▲ and down ▼ buttons.

Step 2. Press the enter ◆ button to save settings.

Info: If the module is locked, active input port cannot be changed.

6.4.4. MODEX-IF-AUD

Settings

- Application mode: Basic working mode can be set; for details about application modes see section [7.5.3](#) on page [44](#).
 - (0) Analog ↔ Emb. & Ret. Aux (default): Analog audio to Main audio Group, S/PDIF to S/PDIF Audio Group (see section [7.5.3.1](#) on page [44](#)).
 - (1) Analog ↔ Forw. & Ret., S/: Analog audio to S/PDIF Audio Group, S/PDIF disabled (see section [7.5.3.2](#) on page [45](#)).
 - (2) S/PDIF → Emb., Analog not: S/PDIF audio in to Main Audio Group, Analog audio disabled (see section [7.5.3.3](#) on page [45](#)).

Changes are stored automatically without pressing the enter ◆ button.

- Analog in: Certain parameters of the input signal can be adjusted as follows:
 - Gain: from 0 dB to +24 dB, step 3 dB (default is 0 dB)
 - Volume: from 0 dB to -63 dB, step 0.5 dB (default is 0 dB)
 - Balance: from 0 to 100%, step 1% (default is 50%=center)

Use the up ▲ and down ▼ buttons to change values. Changes are stored automatically without pressing the enter ◆ button.

- Analog out: Certain parameters of the output signal can be adjusted as follows:
 - Volume: from 0 dB to -52 dB (step 0.5 dB), from -54 dB to -66 dB (step 2 dB); -69 dB; -72 dB; -78 dB (default is 0 dB)
 - Balance: from 0 to 100%, step 1% (default is 50%=center)

Use the up ▲ and down ▼ buttons to change values. Changes are stored automatically without pressing the enter ◆ button.

6.4.5. MODEX-IF-RS232-IR

Settings

- RS232:
 - Baud rate: 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 / 128000 / 153600 / 230400 / 256000
 - Data bits: 5 / 6 / 7 / 8 / 9
 - Stop bits: 1 / 1.5 / 2
 - Parity: None / Odd / Even / Mark / Space
- IR Input
 - Carrier frequency: from 30.000 to 200.000 Hz, step 500 Hz (default is 37.000 Hz)

Use navigation buttons to change values and press the enter ◆ button to store new settings.

6.5. Crosspoints menu

The following simple operations can be done in the crosspoints menu:

- port locking/unlocking,
- port muting/unmuting,
- output switching.

These features are available at the audio and video ports that are installed in the given MODEX.

6.6. USB K&M menu

Connected USB devices' state and basic information are displayed in this menu.


Port 1: , Port 2: 





- Manufacturer
- Product type
- Serial number
- VID
- PID
- 5V present state: (True / False) – only in TX units.
- Device state: (Disconnected / Suspended / Enumerated / Connected) – only in TX units.
- Host info: HID / Free – only in RX units.

6.7. EDID menu (transmitter)





Available input ports are listed in the EDID menu of the transmitter. If there is a DVI and an HDMI input port on the AV module, both will be listed. Currently emulated EDID can be set on each port.


6.7.1. Viewing and changing the emulated EDID

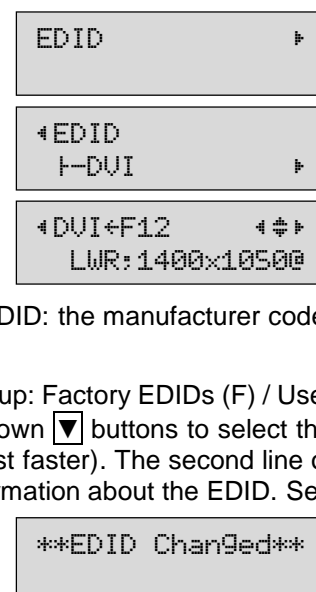
Step 1. Navigate to EDID menu and press the enter  button.

Step 2. Select the desired port by the up  and down  buttons, than press the enter  or the right  button.

Step 3. Currently emulated EDID is shown. In the first line the selected port and the source of the EDID is shown. On attached figure factory EDID nr. 12 is emulated on DVI input port. The second line is scrolled automatically to display more information about the EDID: the manufacturer code, the resolution with the refresh rate and the sink type.

Step 4. Use the left  and right  buttons to select EDID group: Factory EDIDs (F) / User EDIDs (U) / Dynamic EDID (D). Use the up  and down  buttons to select the desired EDID (keep the button pressed to scroll the list faster). The second line of the LCD is scrolled automatically to display more information about the EDID. See more information about EDID structure in section [4.1](#) on page [22](#).

Step 5. Press the enter  button to emulate selected EDID on the input port.



6.8. EDID menu (receiver)

The available video output port is displayed in the EDID menu of the receiver. The EDID of the last attached sink is shown in this menu.

```
◀HDMI+D1
  USC:1600x1200@
```

In the first line the output port (D1, Dynamic EDID) is shown. The second line is scrolled automatically to display more information about the EDID: manufacturer code, resolution with refresh rate and sink type.

Info: Attached monitor's EDID is stored automatically, until a new monitor is attached to that particular output. In case of powering the unit off, last attached monitor's EDID remains in non-volatile memory even if the monitor is unconnected.


6.9. Presets menu

Preset operations can be done in the Presets menu. Each extender has 8 preset memories that can be loaded and saved at any time.




Info: A preset setting stores the full configuration of all input and output ports and emulated EDID settings, so preset loading have an effect on every output, except the locked ones.

6.9.1. Saving a preset



Step 1. Create the desired layout and settings in the extender.

Step 2. Navigate to Presets menu and press the enter  button.

```
◀Presets
  ↳Save Preset ▶
```

Step 3. Select Save preset submenu by the down  button and press the enter , or the right  button.


```
◀Save Preset:
  Preset 1  ⬆⬇⬆
```

Step 4. Select a preset by the up  and down  buttons.




```
Preset saved
```

Step 5. Press the enter  button to save the settings.



6.9.2. Loading a preset

Step 1. Navigate to Presets menu and press the enter  button.

```
◀Presets
  ↳Load Preset ▶
```

Step 2. Select Load preset submenu by the down  button and press the enter , or the right  button.

```
◀Load Preset:
  Preset 1  ⬆⬇⬆
```

Step 3. Select a preset by the up  and down  buttons.

```
Preset loaded
```

Step 4. Press the enter  button to load the preset.

7. Web control – Using the built-in website

MODEX extenders have several configuration options. More settings are available using the built-in website than on the front panel. Connection can be established to the website through any Ethernet connector of the MODEX.

Network structure

MODEX extenders have a front panel Ethernet port. Additional rear-side Ethernet connectors are available on MODEX-IF-ETH interface module. All the connectors and the controller entity belong to the same network inside the MODEX. Ethernet link is also transferred to the connected pair via physical layer link. Connect any RJ45 connector of the transmitter or the receiver to a LAN and you can control both units.

Info: Do not connect more than one port of a MODEX to the same LAN to avoid loops. In the same way; if a MODEX transmitter and a receiver are linked by fiber optical cable, do not connect both to the same LAN, only one of them.

7.1. IP settings

Before you connect to a MODEX extender using a Web browser the IP address must be set. The Ethernet port can be configured on the front panel LCD menu or remotely through the built-in website. There are three different ways to configure the IP address.

Set the factory default static IP address

MODEX extenders have static IP settings at the first startup. You can reload these settings to the default state by the LCD menu (Settings / System / Factory Default). For detailed information about this step see section [6.3.1](#) on page [30](#). Factory default IP addresses are described in section [10.5.1](#) on page [87](#).

Set a user-defined static IP address

IP address, Subnet mask and Static gateway can be set by the user on front panel LCD menu (Settings / Network Settings). For detailed information about this step see section [6.3.1](#) on page [30](#).

Set a dynamic IP address

DHCP mode can be enabled on the front panel LCD menu (Settings / Network Settings / DHCP). The extenders acquire IP addresses from the DHCP server on the LAN in this case. For detailed information about this step see section [6.3.1](#) on page [30](#).

Port settings

Port setting has no influence on the connection if the built-in web is used to control the MODEX. When the extender is connected by LAN, port nr. 80 and 81 are used which cannot be changed.

Info: Port setting has an influence when firmware upgrade is performed.

7.2. Establishing the connection

To connect to a MODEX launch a web browser and type the IP address. You can verify the actual address of the MODEX unit on its front panel display (Settings / Network).

Info: Built-in webpage can be opened at most in 4 different browser tabs simultaneously.

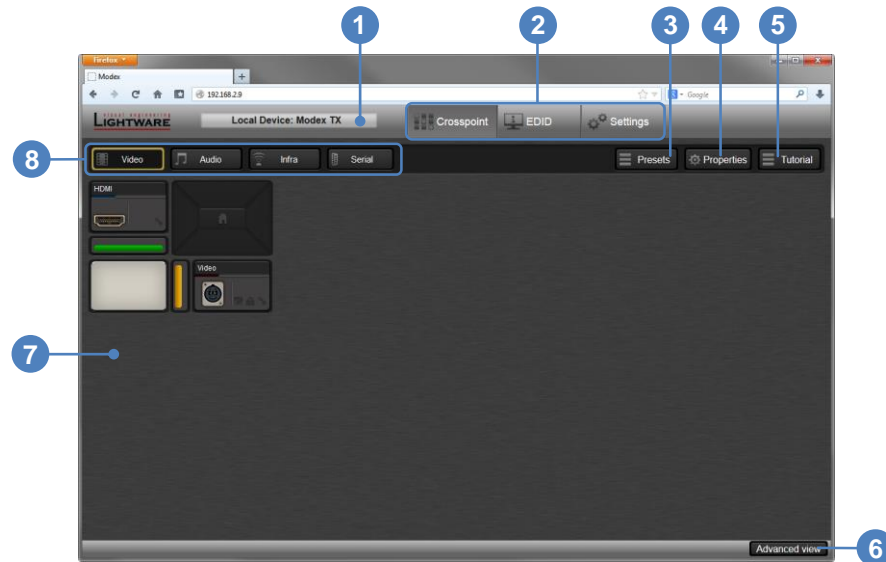
System requirements

Operating System: Microsoft Windows XP, Windows Vista, Windows 7, Mac OS X, or Linux.

Web Browser: Mozilla Firefox, Apple Safari (Microsoft Internet Explorer is not supported).

7.3. Layout of built-in web

After the connection is established Crosspoint menu appears by default. Device selector indicates which device has been connected to. This is the local device. In this window remote device can be selected. Both devices must be configured for appropriate transfer. There are three tabs in main menu: **Crosspoint**, **EDID** and **Settings**.



- | | | |
|---|----------------------|--|
| 1 | Device selector | Selecting Local or Remote Device by clicking the grey tab; it will be loaded in the browser window. |
| 2 | Main menu | Displaying Crosspoint, EDID or Settings from the main menu. |
| 3 | Preset button | Displaying the Preset window to save or load the extender's full configuration. |
| 4 | Properties button | Toggling right panel display, showing the properties of selected port. The panel is also displayed when left-clicking on a port. |
| 5 | Tutorial button | Displaying MODEX tutorial in the appearing window containing the most important descriptions shortly. |
| 6 | Advanced view button | Displaying Advanced view page, showing the terminal window and the protocol tree. |
| 7 | Active area | Displaying the content of the selected menu and module. |
| 8 | Layers | Showing the available layers as submenus; they depend on the installed interface modules. |

Local and remote control

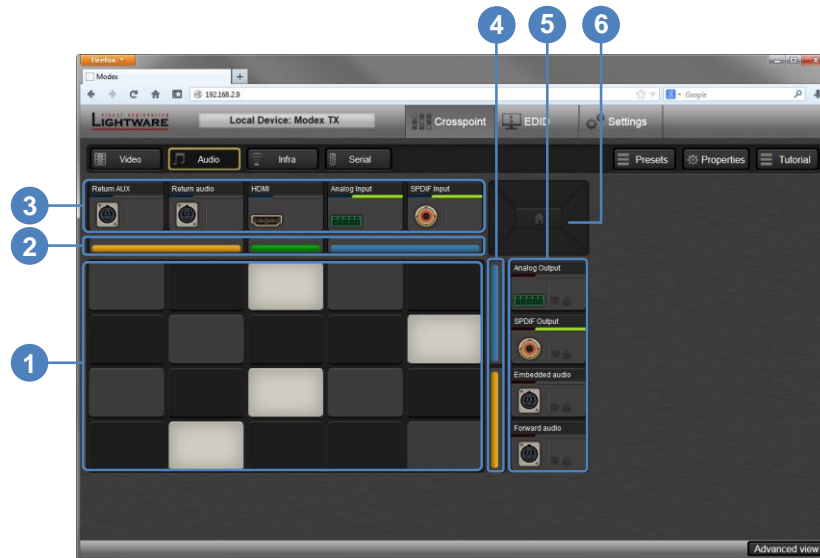
When the transmitter and the receiver are linked by a fiber cable and one of them is connected to a LAN, the other extender can be also controlled. In this case the extender that is connected by the LAN cable is the Local Device, the other extender is the Remote Device.

7.4. Crosspoint menu

MODEX is a multi-layer extender and each layer has an own specific control panel for configuration. Left click on the Crosspoint label in the main menu to obtain layers of configuration panel supported by the selected MODEX extender pair.







Info: USB KVM has no crosspoint configuration panel.

Info: If a layer is not supported by the selected MODEX, its menu is not displayed.



- | | |
|---|--|
| <p>1 Crosspoint panel</p> <p>2 Input module properties</p> <p>3 Input ports</p> <p>4 Output module properties</p> <p>5 Output ports</p> <p>6 Navigation buttons</p> | <p>Displaying connections between the input and output ports:</p> <p>Dark tiles: Connection is not possible.</p> <p>Grey tiles: Connection is possible but not established.</p> <p>White tiles: Connection is established.</p> <p>Each color bar represents a module. Properties window appears displaying information and settings about the given input module by clicking on the colored bar.</p> <p>Displaying available input ports of the selected layer. Properties panel can be displayed on the right side by clicking on its button.</p> <p>Each color bar represents a module. Properties window appears displaying information and settings about the given output module by clicking on the colored bar.</p> <p>Displaying available output ports of selected layer. Properties panel can be displayed on the right side by clicking on its button.</p> <p>If the window is smaller than required, input and/or output ports may not fit in the available area. Thus the arrows on this button get activated and the ports can be scrolled. Clicking in the middle icon restores the original layout (crosspoint is arranged to the left top corner).</p> |
|---|--|

Icons on the ports:

- | | |
|---|--|
|  HDCP is enabled and the signal is encrypted (black) |  HDCP is disabled or the signal is not encrypted (grey) |
|  Port is muted (black) |  Port is unmuted (grey) |
|  Port is locked (black) |  Port is unlocked (grey) |

7.4.1. Video crosspoint

The number of the inputs and the outputs are depending on the number and the direction of the video modules. As MODEX supports only one video transmission over the link, the link appears as an input or as an output depending on the direction of the extender.

At the transmitter side the link appears as an output. At the receiver side the link appears as an input.



Figure 7-1. Video crosspoint (Transmitter)

Example

Above figure shows one input and one output. HDMI is the input port and the output port is the fiber optical connector – towards to the receiver. In this case there is no real crosspoint switching, the signal of the input port is always switched to the output port (except if the output is muted).

7.4.2. Audio crosspoint

MODEX extenders support two audio groups: the Main audio group and the S/PDIF audio group. These groups are independent from each other. In this case there are forbidden crosspoint connections. The link can support four audio layers:

Main audio group:

- Embedded audio (from transmitter to receiver)
- Return AUX (from receiver to transmitter)

S/PDIF audio group:

- Forward Audio (from transmitter to receiver)
- Return Audio (from receiver to transmitter)

At the transmitter side the Embedded audio and the Forward Audio appears as an output, the Return Audio and the Return AUX appears as an input. At the receiver side the direction is the opposite.

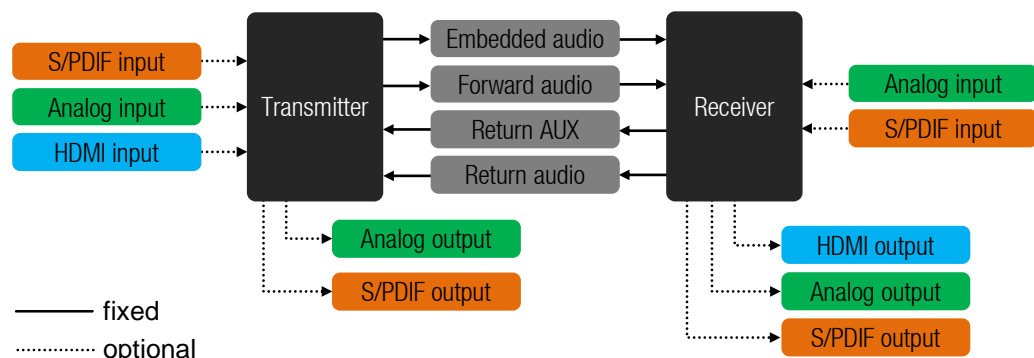


Figure 7-2. Audio layers

The four audio layers, between the transmitter and the receiver are defined and fixed, always extended. The other audio inputs and outputs are optional and depend on the installed interface modules; the available crosspoint settings depend on the application mode set in the properties of the audio module.



Figure 7-3. Audio crosspoint

Example

Above screenshot was made of a MODEX transmitter's Audio crosspoint layout (assembled with MODEX-IF-AUD module). Settings are according to section [7.5.3.1](#) on page [44](#).

The following connections are established:

- HDMI audio input port is switched to Analog Output and to Embedded audio,
- S/PDIF input port is switched to S/PDIF output port,
- Return audio is switched to Forward audio.

Info: To have the desired audio crosspoint setup, check the settings in both extenders.

7.4.3. Infra crosspoint

The number of the available ports in a unit is determined as follows:

Number of inputs = Number of inputs [local unit] + Number of inputs [remote unit]

Number of outputs = Number of outputs [local unit]

All infrared inputs are transmitted to the remote device all the time. As the data of all infra input ports can be transmitted via the link, the link does not appear as an output as it appears in the video or in the audio crosspoints. The input port with a link icon symbolizes the input of the remote side.

Info: The selection should be done on the local device which infra source(s) has/have to be output on a local infra port.

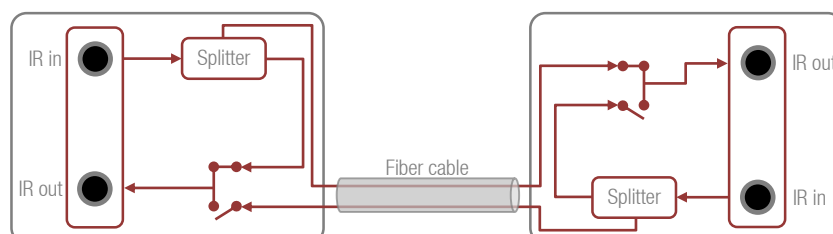


Figure 7-4. IR layout between transmitter and receiver

The input and output settings are available under port properties; each port is represented by a connector icon.






Figure 7-5. Infra crosspoint

Example

Above screenshot shows an Infra crosspoint layout of a MODEX assembled with MODEX-IF-RS232-IR module. Local IR input signal is switched to the IR output port within the given module – and extended to the other MODEX as well.

Info: The signal of the local input port is always extended via the fiber optical cable, but the other device's Infra crosspoint settings determine if the incoming signal is switched to its IR output port or not.

Further examples:

| | | |
|-----------|---|--|
| Example 1 |  | IR signal received via fiber optical cable is switched to the IR output port. Local IR input signal is extended via fiber optical cable. |
| Example 2 |  | IR signal of local input port and IR signal received via fiber cable are mixed on each other and switched to the IR output port. Local IR input signal is extended via fiber optical cable. |
| Example 3 |  | Only local IR input signal is transmitted to the other extender. |

7.4.4. Serial crosspoint

The number of the available ports in a unit is determined as follows:

Number of inputs = Number of the ports [local unit] + Number of the ports [remote unit]

Number of outputs = Number of the ports [local unit]

In crosspoint view every serial port appears as an input and an output. It means that Tx data channel of the port is an input and Rx data channel is an output – within one port.

All serial inputs are transmitted to the remote device all the time. As all serial ports data can be transmitted via the link, the link does not appear as an output as it appears in video or in audio crosspoints. The input port with a link icon symbolizes the input of the remote side.

Info: The serial source switched to the local output can be selected on the local device.

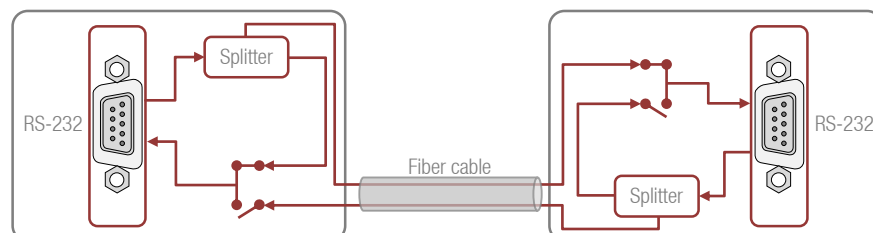


Figure 7-6. Serial layout between transmitter and receiver.

If an input is switched to an output, and both the input and the output belongs to the same serial port connector, that results an internal loopback. This way the serial link can be tested between the source and the MODEX extender device.



Figure 7-7. Serial crosspoint

Example

The working method is the same as for Infra crosspoint settings.

Above screenshot was made about a Serial crosspoint layout of a MODEX (assembled with MODEX-IF-RS232-IR module). Local UART input signal (on Rx data lane) and the signal received via fiber optical cable are switched to the UART output port (Tx data lane) within the given module. Local UART input signal is extended also to the other MODEX.

Info: The signal of the local input port is always extended via the fiber optical cable, but the other device's Serial crosspoint settings determine if the incoming signal is switched to its UART output port or not.

Further examples:

Example 1



Signal received on local UART port (Rx data lane) is switched to the Tx data lane of the port and extended to the other MODEX as well.

Example 2



Signal received via fiber optical cable is switched to the local UART port (Tx data lane). Signal received on local UART port (Rx data lane) is extended to the other MODEX.

Example 3



Signal received on local UART port (Rx data lane) is extended to the other MODEX.

7.4.5. Preset settings

Each MODEX extender has eight preset memories that can be used to store settings and configurations of the MODEX. Click on the Presets button in the right top corner to display the Presets window.

Info: A preset setting stores the full configuration of all modules, ports and system settings. EDID data is not stored, but the ID number of the emulated EDID is saved – for every input port.

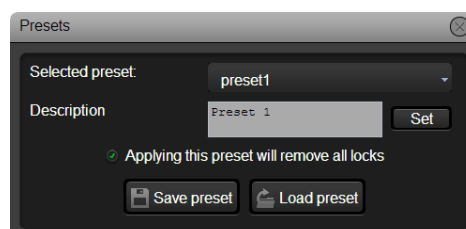


Figure 7-8. Presets window

Saving a preset

- Step 1.** Create the desired crosspoint connections, port and module settings.
- Step 2.** Select Crosspoint view and click on Presets button.
- Step 3.** Select the desired preset memory from the dropdown menu.
- Step 4.** Optionally write a short description and store it by the Set button (description can be also stored without saving/loading a preset).
- Step 5.** Click on Save preset button.

Loading a preset

- Step 1.** Select Crosspoint view and click on Presets button.
- Step 2.** Select a preset from the dropdown menu.
- Step 3.** Optionally mark or unmark the 'Applying this preset will remove all locks' setting.
- Step 4.** Click on Load preset button.

Info: Loading a preset does not change User EDID memory.

Info: If a place in the User EDID memory has been changed after saving the preset, the EDID itself will not be changed when loading the preset. The new EDID saved in the place will be valid, since a preset stores the ID number of an emulated EDID, not the EDID data.

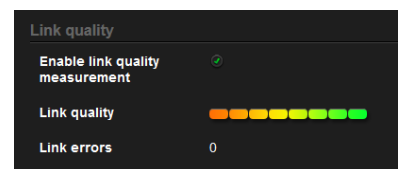
7.5. Module properties and settings

General

General information is displayed about the module: Module name, Part number, Hardware version, Serial number and further module-dependent information and settings.

7.5.1. Optical link quality

The properties panel of MODEX-PH-OPTx module contains a feature that gives information about the optical link quality between the transmitter and the receiver. (Scroll down in the window and the section will be visible.) If the radio button is checked, link quality measurement is in progress (data is collected in the background). If the button is unchecked, error counter is reset to 0.

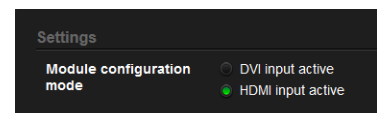


Info: If the module (MODEX-PH-OPTx) is locked, link quality measurement cannot be enabled or disabled.

7.5.2. Video modules

MODEX modules – including video-, interface- and physical link modules – have their special property list. Related ports are indicated by the color of the module property bar. Different color means different module. Left click on Module property bar to open module property window.

Certain video modules have more than one video inputs or outputs, but only one of these inputs or outputs can be used in video crosspoint. The reason is that only one video stream transmission is permitted between the core module and the video module. Under Settings there is a Mode selector which activates the interface. The active input or output port of selected mode appears in video crosspoint and the port property becomes available.



Info: If the module is locked, the active interface cannot be changed.

7.5.3. Audio modules

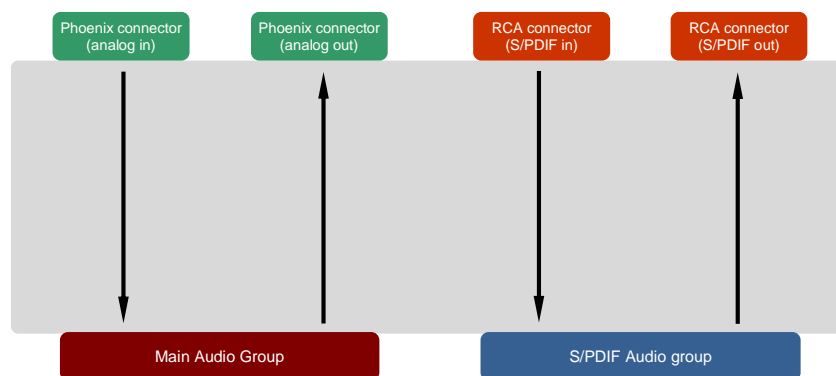
Each MODEX modules – including video-, interface- and physical link modules – have their special property list. Related ports are indicated by the color of the module property bar. Different color means different module. Left click on Module property bar to open module property window.

There is a mode selector under Settings of Audio modules. Each audio port can be assigned to one of the two audio groups (Main or S/PDIF) using mode function. After setting the mode of the audio interface module, the supported input and/or output port of the selected mode appears in audio crosspoint and the port property window becomes available.

Info: This setting can be set in the transmitter and in the receiver separately.

Info: If the module is locked, the audio interface mode cannot be changed.

7.5.3.1. Analog audio to Main Audio Group, S/PDIF to S/PDIF group



Available connections

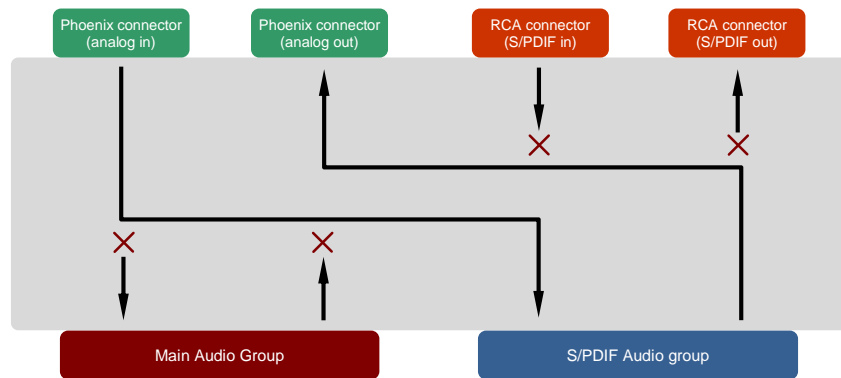
| Transmitter | | | | | |
|-------------|--------------|------|--------------|--------------|----------------|
| Return AUX | Return audio | HDMI | Analog Input | S/PDIF input | |
| ✓ | | ✓ | ✓ | | Analog output |
| | ✓ | | | ✓ | S/PDIF Output |
| ✓ | | ✓ | ✓ | | Embedded audio |
| | ✓ | | | ✓ | Forward audio |

Table 7-1. Available connections (when setting in the transmitter)

| Receiver | | | | |
|----------------|---------------|--------------|--------------|---------------|
| Embedded audio | Forward audio | Analog Input | S/PDIF input | |
| ✓ | | ✓ | | HDMI |
| ✓ | | ✓ | | Analog output |
| | ✓ | | ✓ | S/PDIF Output |
| ✓ | | ✓ | | Return AUX |
| | ✓ | | ✓ | Return audio |

Table 7-2. Available connections (when setting in the receiver)

7.5.3.2. Analog audio to S/PDIF Audio Group, S/PDIF disabled



Available connections

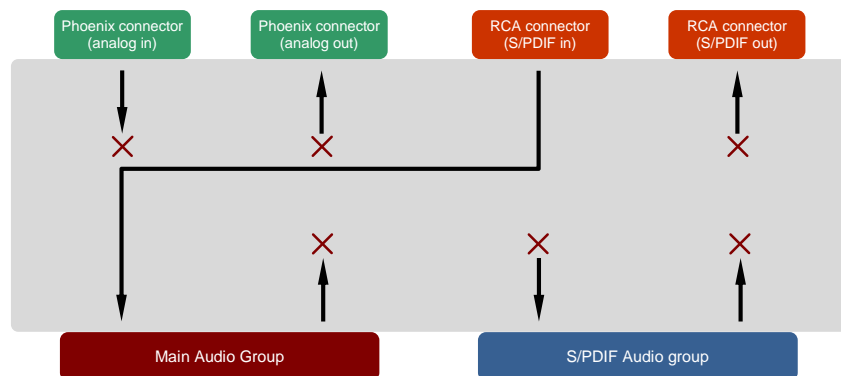
| Transmitter | | | | |
|-------------|--------------|------|--------------|----------------|
| Return AUX | Return audio | HDMI | Analog Input | |
| | ✓ | | ✓ | Analog output |
| ✓ | | ✓ | | Embedded audio |
| | ✓ | | ✓ | Forward audio |

Table 7-3. Available connections (when setting in the transmitter)

| Receiver | | | |
|----------------|---------------|--------------|---------------|
| Embedded audio | Forward audio | Analog Input | |
| ✓ | | | HDMI |
| | ✓ | ✓ | Analog output |
| ✓ | | | Return AUX |
| | ✓ | ✓ | Return audio |

Table 7-4. Available connections (when setting in the receiver)

7.5.3.3. S/PDIF audio in to Main Audio Group, Analog audio disabled



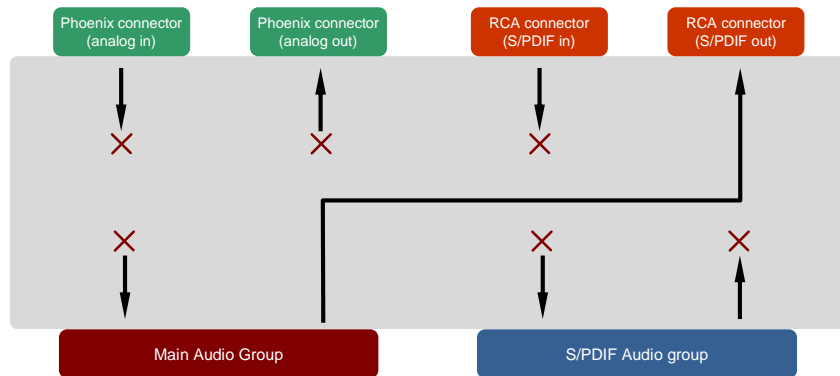
| Transmitter | | | | |
|-------------|--------------|------|--------------|----------------|
| Return AUX | Return audio | HDMI | S/PDIF input | |
| ✓ | | ✓ | ✓ | Embedded audio |
| | ✓ | | | Forward audio |

Table 7-5. Available connections (when setting in the transmitter)

| Receiver | | | |
|----------------|---------------|--------------|--------------|
| Embedded audio | Forward audio | S/PDIF input | |
| ✓ | | ✓ | HDMI |
| ✓ | | ✓ | Return AUX |
| | ✓ | | Return audio |

Table 7-6. Available connections (when setting in the receiver)

7.5.3.4. S/PDIF audio out from Main Audio Group, Analog audio disabled



| Transmitter | | | |
|-------------|--------------|------|----------------|
| Return AUX | Return audio | HDMI | |
| ✓ | | ✓ | S/PDIF output |
| ✓ | | ✓ | Embedded audio |
| | ✓ | | Forward audio |

Table 7-7. Available connections (when setting in the transmitter)

| Receiver | | |
|----------------|---------------|---------------|
| Embedded audio | Forward audio | |
| ✓ | | HDMI |
| ✓ | | S/PDIF output |
| ✓ | | Return AUX |
| | ✓ | Return audio |

Table 7-8. Available connections (when setting in the receiver)

7.6. Port properties and settings

Left click on Port property icon to open Property window. The physical port, the input and the output ports have different property windows. Status information about the port and signal information about incoming and outgoing signals are displayed in the property window. At the same time it gives the opportunity to set parameters, rename a port or access special functions – e.g. Frame detector at input port side.

Muting (only on output ports)

Outputs can be easily muted by clicking on the button Unmuted. If the output is muted, button text is Muted. When a port is muted, no signal is present on the output.

Locking (only on input ports)

Outputs can be easily locked by clicking on the button Unlocked. If the output is locked, button text is Locked.

Info: If the port is locked, its mute state cannot be changed neither by the button, nor by loading a preset.

Port name

The name of a port can be changed by typing the new name and clicking the Set button. The change will be visible on the port button and on front panel menu.

The following characters are allowed when naming:

Letters (A-Z) and (a-z), hyphen (-), underscore (_), numbers (0-9) and dot (.).

Frame detector (on video input ports)

Input ports can show detailed information about the signal like blanking intervals and active video resolution. This feature is a good troubleshooter if compatibility problems occur during system installation. To access this function, open parameter window for the input port on which the signal has to be checked. Click on Frame Detector button to show detailed timings.

Frame detector

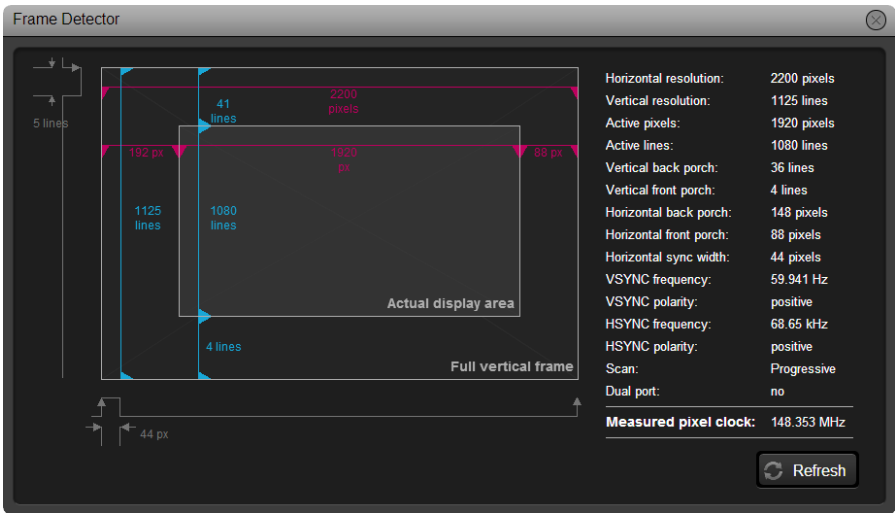


Figure 7-9. Frame detector window

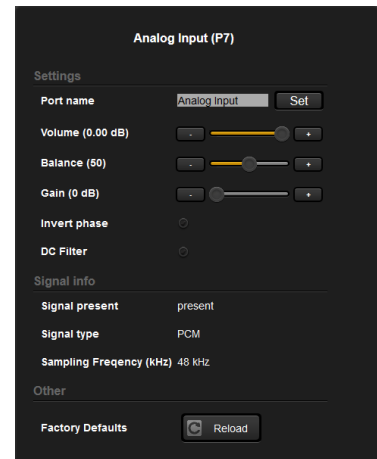
Lightware's frame detector function works like an input signal analyzer and makes possible to determine the exact video format that is sent by the source, thus helps to identify many problems. E.g. actual timing parameters may differ from the expected and this may cause some displays to drop the picture.

Frame detector measures detailed timings on the matrices' incoming video signals just like a built-in oscilloscope, but it is much more easy to use. Actual display area shows the active video size (light grey). Dark gray area of the full frame is the blanking interval which can contain the info frames and embedded audio data for HDMI signals. Shown values are measured actually on the signal and not retrieved only from the HDMI info frames.

7.6.1. Analog audio input port

Certain parameters of analog audio input signal can be adjusted as follows:

- Volume:
from 0 dB to -52 dB (step 0.5 dB), from -54 dB to -66 dB (step 2 dB); -69 dB; -72 dB; -78 dB (default is 0 dB)
- Balance:
from 0 to 100%, step 1% (default is 50%=center)
- Gain:
from 0 to 24 dB, step 3 dB (default is 0 dB)
- Invert phase: enabled/disabled
- DC filter: enabled/disabled



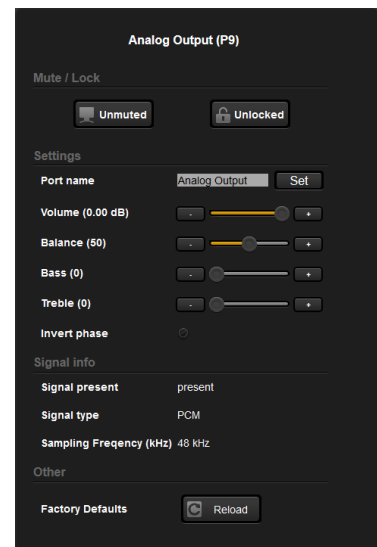
Current values are displayed in brackets.

Info: Reload button resets default Name of the port, and default values of Volume, Balance, Bass, Treble and Invert phase settings.

7.6.2. Analog audio output port

Certain parameters of analog audio output signal can be adjusted as follows:

- Volume:
from 0 dB to -52 dB (step 0.5 dB), from -54 dB to -66 dB (step 2 dB); -69 dB; -72 dB; -78 dB (default is 0 dB)
- Balance:
from 0 to 100%, step 1% (default is 50%=center)
- Bass:
from 0 to 24, step 2 (default is 0)
- Treble:
from 0 to 6, step 2 (default is 0)
- Invert phase: enabled/disabled



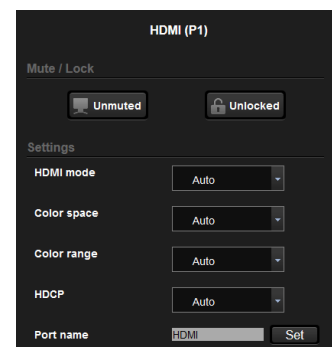
Current values are displayed in brackets.

Info: Reload button resets default Port name, and default values of Volume, Balance, Bass, Treble and Invert phase settings.

7.6.3. HDMI output port

The properties panel of HDMI output port contains the following adjustable settings:

- HDMI mode:
Auto / DVI / HDMI 24 bit / HDMI 30 bit / HDMI 36 bit
- Color space:
Auto / RGB / YCbCr 4:4:4 / YCbCr: 4:2:2
- Color range:
Auto / Compress / Expand
- HDCP:
Auto / Always



7.6.4. HDMI input port

Only one setting belongs to HDMI input port: HDCP can be enabled or disabled.

7.6.5. SDI port

SDI channel configuration window can be displayed by pressing its button on properties panel.

Channel configuration

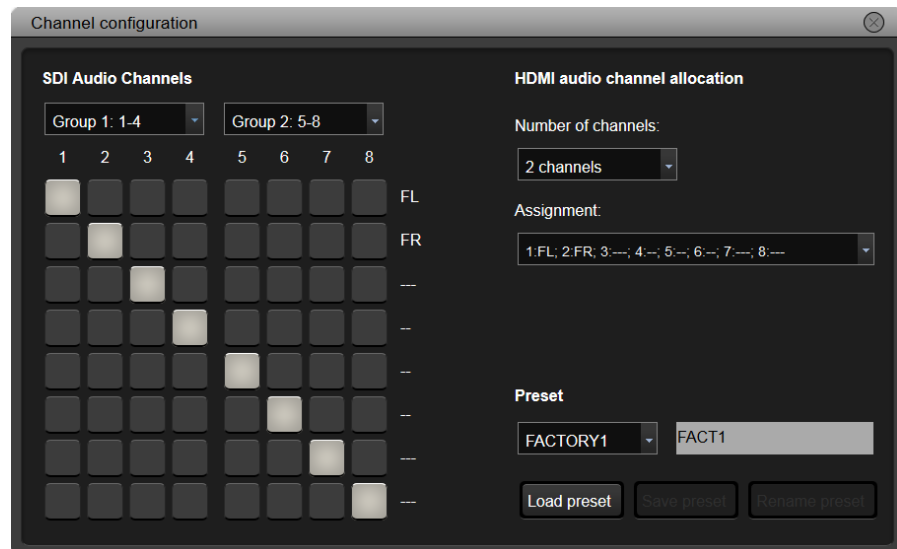


Figure 7-10. SDI Channel configuration

SDI Audio Channels

SDI signal can carry up to 16 audio channels – 8 of them can be allocated to dedicated channels in line with HDMI audio channel allocation settings. Select the two groups from the drop-down menus and click on a cube to connect the channels. (Same groups cannot be selected at the same time.)

Info: Channel assignment is not changed on the cubes when another group is selected from the drop-down menu – layout of the cubes remains unchanged.

HDMI audio channel allocation

Number of channels can be selected from 2 to 8 channels:

| Number of channels | Assignment |
|--------------------|--|
| 2 | 1:FL; 2:FR |
| 3 | 1:FL; 2:FR; 3:LFE |
| 4 | 1:FL; 2:FR; 3:LFE; 4:FC |
| 5 | 1:FL; 2:FR; 3:LFE; 4:FC; 5:RL |
| 6 | 1:FL; 2:FR; 3:LFE; 4:FC; 5:RL; 6:RR |
| 7 | 1:FL; 2:FR; 3:LFE; 4:FC; 5:RL; 6:RR; 7:RLC |
| 8 | 1:FL; 2:FR; 3:LFE; 4:FC; 5:RL; 6:RR; 7:RLC; 8:RRC, or 1:FL; 2:FR; 3:LFE; 4:FC; 5:RL; 6:RR; 7:FLC; 8:FRC |

Table 7-9. HDMI audio channel allocation

Preset

Preset memories can be used to store SDI audio settings and configurations. There are 4 factory and 5 user programmable preset memories. Factory presets cannot be changed, and cannot be renamed. User programmable preset memories can be saved, changed, loaded and renamed as well.

Info: Preset memory stores the full configuration of SDI audio settings: channel allocation and assignments.

7.6.6. IR port

The followings can be set on the properties panel of IR port:

- Carrier frequency [kHz] (set according to the needs of the IR device). The value can be set between 30 and 200 kHz with one decimal, further digits are truncated. E.g. if typed value is '37.52', saved value is '37.5'. Default value is 38.0 kHz.
- Port name, which will be visible on its button and in Modules of front panel menu.)

Info: Reload button resets default Name of the port and default value of Carrier frequency.

7.6.7. RS232 port

The properties window contains adjustable settings of RS232 port as follows:

- Baud rate: 2400 / 4800 / 9600 / 19200 / 38400 / 57600 / 115200 / 128000 / 153600 / 230400 / 256000 baud
- Data Bits: 5 / 6 / 7 / 8 / 9
- Stop Bits: 1 / 1.5 / 2
- Parity: None / Odd / Even / Mark / Space

Port name can be set, which will be visible on its button and in Crosspoint settings of front panel menu.

RS232 output port has two more buttons to set muting and locking status.

Info: Reload button resets default Name of the port and default values of Baud rate, Data Bits, Stop bits and Parity.

7.7. EDID menu

Advanced EDID Management can be accessed by selecting EDID menu.

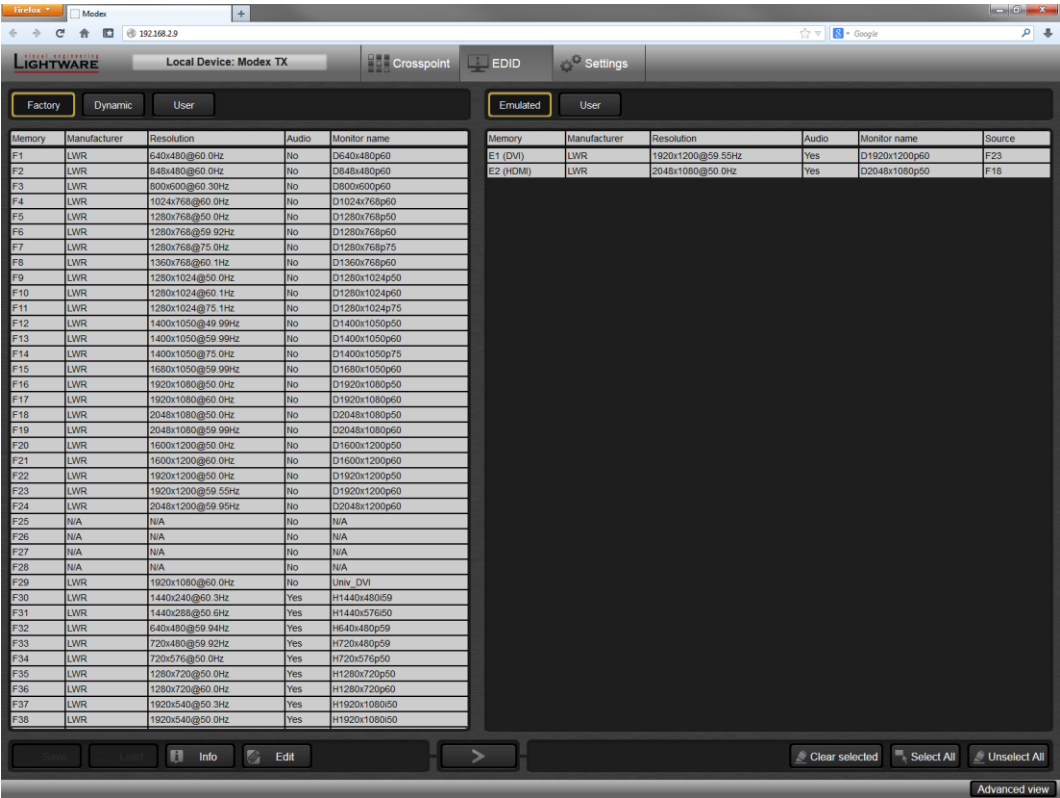










Figure 7-11. EDID management

The window contains two panels: left panel contains the EDIDs that can be used as a source; right panel contains the target places where the EDIDs can be emulated. The list can be scrolled by mouse wheel or by grabbing the list.

Control buttons

| | | |
|---|----------------|--|
|  | Save | Exporting an EDID (save to a file) |
|  | Load | Importing an EDID (load from a file) |
|  | Info | Opening EDID Summary window showing selected EDID |
|  | Edit | Opening Advanced EDID Editor with selected EDID |
|  | | Executing EDID emulation/learning (Transfer button) |
|  | Clear selected | Deleting EDID (from user memory) |
|  | Select All | Selecting all memory places in the right panel |
|  | Unselect All | Selecting none of the memory places in the right panel |

Detailed information about EDID memory structure (transmitter) can be found in section [4.3](#) on page [23](#).

7.7.1. Changing emulated EDID

- Step 1.** Select desired EDID list from one of the three sources by pressing its button above left panel.
- Step 2.** Select an EDID from the left panel that has to be emulated; the EDID will be highlighted with yellow cursor.
- Step 3.** Press Emulated button above right panel; currently emulated EDID is shown.
- Step 4.** Select desired port where the EDID has to be emulated (more ports can also be selected); the EDID will be highlighted with yellow cursor.
- Step 5.** Press Transfer button to change emulated EDID.

7.7.2. Learning an EDID

Info: The process is the same like changing emulated EDID; the only difference is the target on the right panel: select 'User' button. Thus one or more EDIDs can be copied into user memory either from factory memory or from a connected sink (Dynamic).

7.7.3. Exporting an EDID

The EDID listed in left panel can be downloaded as a file (*.bin) to the computer.

- Step 1.** Select desired EDID from the left panel (the EDID has to be highlighted with yellow cursor).
- Step 2.** Press Save button to download the file to the computer.

7.7.4. Importing an EDID

Previously saved EDID (*.bin file) can be imported into user memory as follows:

- Step 1.** Press User button above left panel.
- Step 2.** Select a memory slot from the list; it will be highlighted with yellow cursor.
- Step 3.** Press Load button below left panel.
- Step 4.** Browse the file in the opening window then click on Load EDID. Browsed EDID is imported into the selected User memory slot.

Info: The imported EDID overwrites the selected memory slot even if it is not empty.

7.7.5. EDID Summary window

Select an EDID in the left panel and press Info button to display EDID summary.

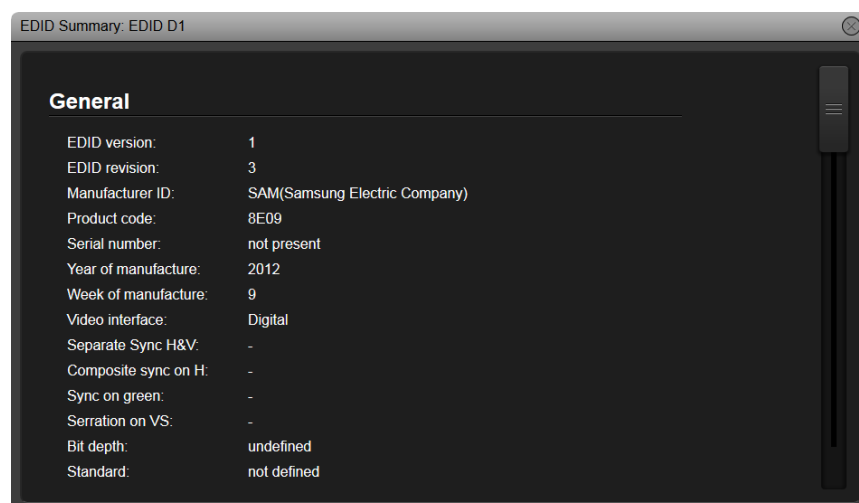


Figure 7-12. EDID Summary

7.7.6. Editing an EDID

Select an EDID from left panel and press Edit button to display Advanced EDID editor window. Modified EDID can be stored in user memory.

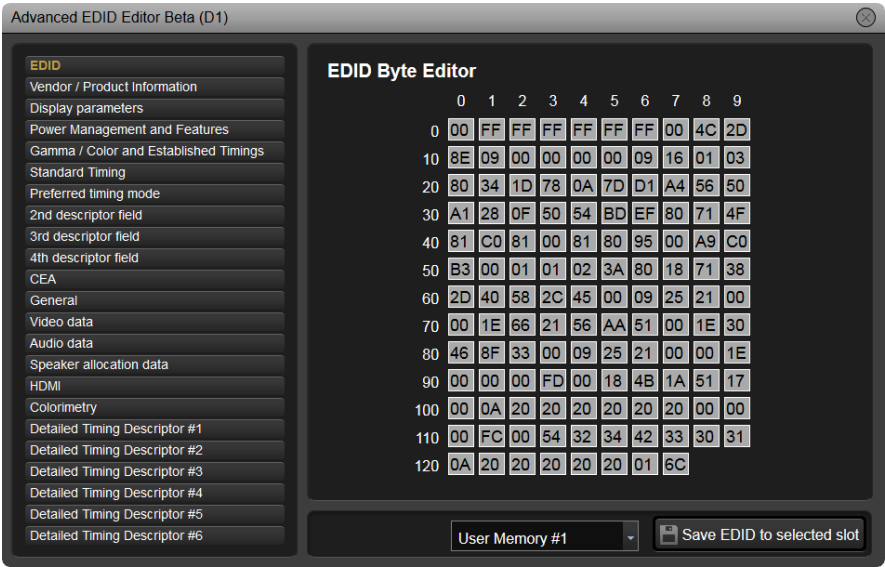


Figure 7-13. Advanced EDID Editor

7.7.7. Deleting EDID(s)

The EDID(s) in User memory can be deleted as follows:

- Step 1. Click on User button above right panel.
- Step 2. Select one or more EDID from the list that are desired to be deleted.
- Step 3. Click on Clear selected button to delete selected EDID(s).

7.8. Settings menu

Reboot

When Settings menu is selected, Reboot button is displayed in the right top corner; click on the button and a pop-up window appears. The extender reboots only if Reboot button is clicked in the window.

7.8.1. Core submenu

The submenu displays information about MODEX frame. Device label can be also changed which is visible on the front panel LCD.

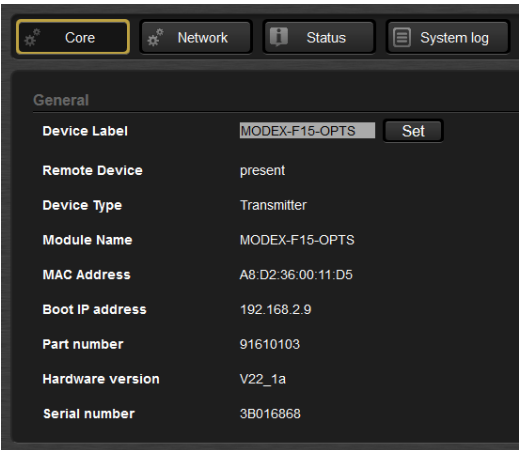


Figure 7-14. Core submenu

7.8.2. Network submenu

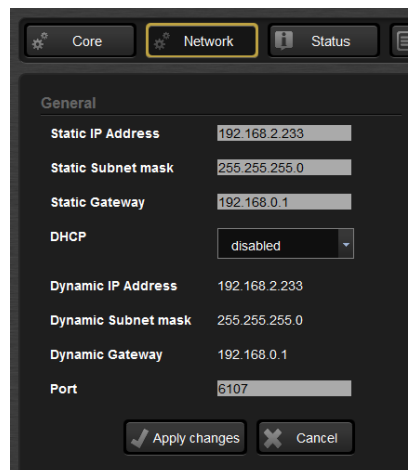


Figure 7-15. Network submenu

When the extender is connected to a network or directly to a computer, the necessary settings can be set in this submenu. If a fixed IP address is planned to use, fill Static IP address, Static subnet mask and Static gateway fields. If dynamic IP address is planned to use, set DHCP to Enabled from the drop-down list; other settings are made automatically.

Port number setting has an influence only when connecting to a third party device or doing firmware upgrade. Click on Apply changes button to save settings.

Info: Port setting has no influence on the connection if the built-in web is used to control the MODEX. When the extender is connected by LAN, port nr. 80 and 81 are used which cannot be changed.

7.8.3. Status submenu

Besides some general information and firmware versions in left panel, name of the installed modules are listed in the right panel of this submenu. System time means the elapsed time since last boot.

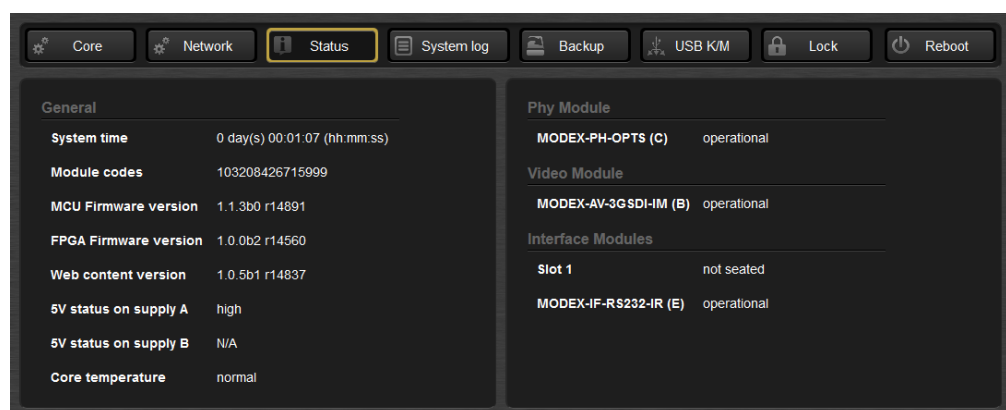


Figure 7-16. Status submenu

Info: Supply B is reserved for future developments.

7.8.4. System log submenu

The submenu shows events that have been logged by MODEX. Click on the buttons below log window to display Warnings, Errors, Fatal errors or Notices. The log can be scrolled by clicking arrow buttons on the right. To display all listed events within the group (e.g. Warnings) click on More button; all events will be listed in a new window.

Click on Export button to collect all events and display on a new page.

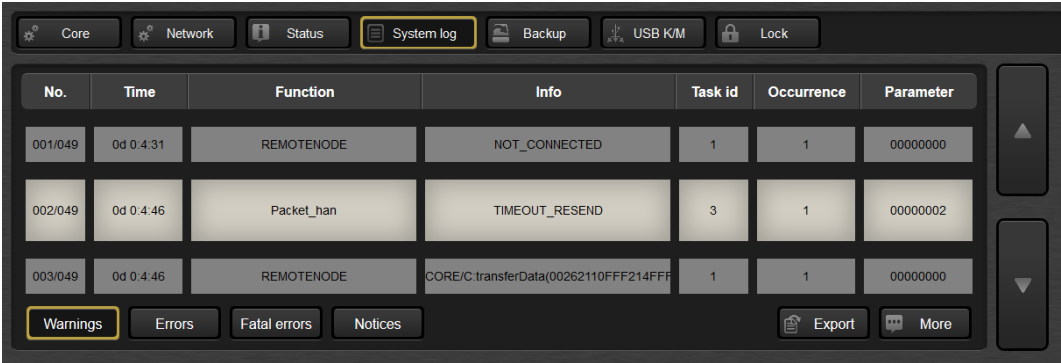


Figure 7-17. System log submenu

7.8.5. Backup submenu

This feature is under development.

7.8.6. USB K/M

Connected USB devices and the status are displayed on the panels:

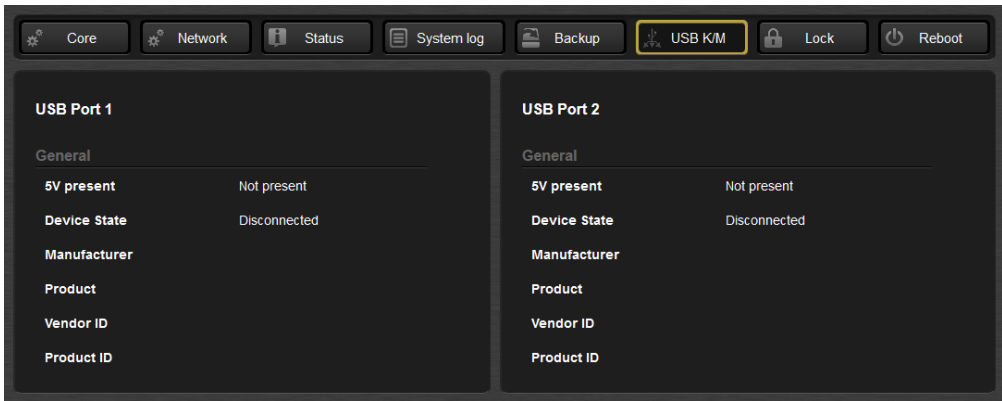


Figure 7-18. USB K/M submenu

Device states

- Disconnected: No device is connected to the USB port and no device is emulated to the computer.
- Enumerated: USB device is connected and install is in progress.
- Connected: USB device is connected to the receiver and emulated on the computer.
- Suspended: Keyboard and mouse functions are emulated by the extender and no USB enumeration occurs while operator switching. A computer is not aware when the device has been changed. When the state is Suspended, device is disconnected from the extender however it is still emulated to the computer.

7.8.7. Lock submenu

Locking a module means settings of the module cannot be changed: neither on user interface, nor by protocol commands (Advanced view); however it will be still active. Modules and settings can be locked on this page:

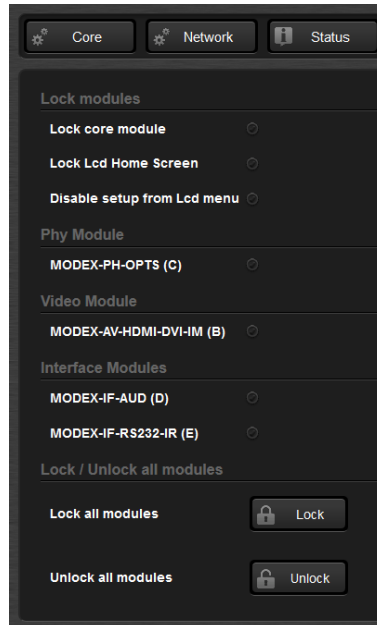


Figure 7-19. Lock submenu

- **Lock core module:** Crosspoint change is not allowed on any layer (Video, Audio, Infra, Serial, etc...).
- **Lock LCD Home Screen:** When this option is checked, front panel menu is locked. Only idle state is shown, front panel operations are disabled.
- **Disable setup from LCD menu:** Front panel menu is available, but settings cannot be changed.

7.9. Advanced view

Advanced view is the surface for LW3 protocol settings with terminal window. Commands and specific parameters (that are not available on the user interface) can be run and set. Detailed information about the protocol, nodes, methods and parameters can be found in chapter 8 on page 58. Click on Close button to hide Advanced view.

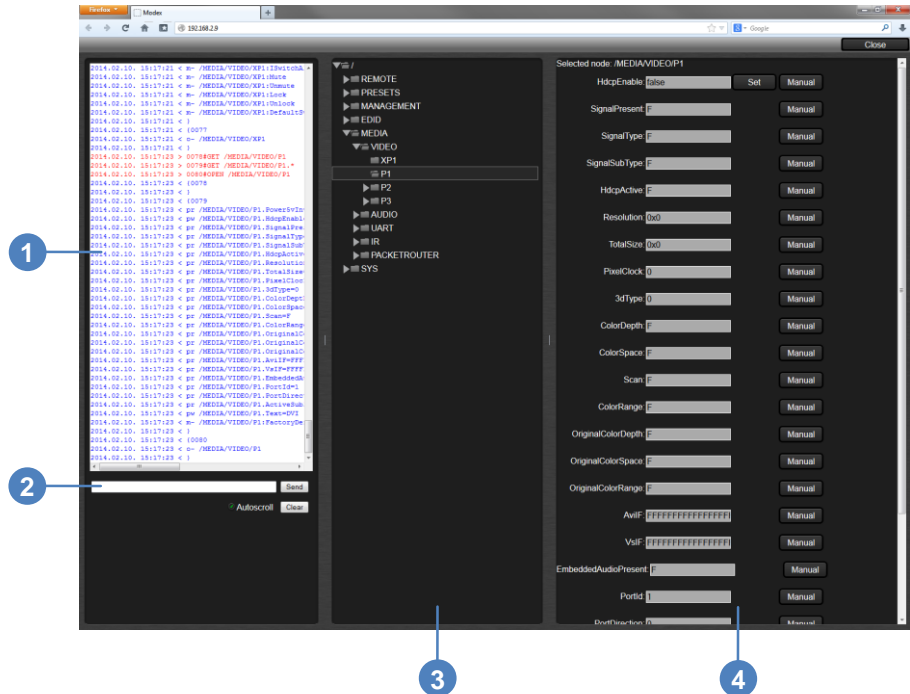


Figure 7-20. Debug window

- 1 Terminal window
Commands and responses are listed in this window. The timecode in every row shows the exact time when the command was sent or the response received. Sent command is displayed in red and starts with ' > ' character, received response is displayed in blue and starts with ' < ' character. The content of the window can be emptied by the Clear button.
- 2 Command line
Command text can be typed directly by this field and executed by the Send button.
- 3 Protocol tree
The protocol tree is available via this panel. Select an item to see its content.
- 4 Node list
Correspondent parameters and nodes are shown which are connected to the selected item in the protocol tree.

| | |
|----------------|--|
| Manual button: | Manual (short description) of the node can be called and displayed in the terminal window. See more information about manuals in section 8.2.9 on page 66. |
| Set button: | Saves the value/parameter typed in the textbox. |
| Call button: | Calls the method, e.g. reloads factory default settings. |

Info: If a module is locked, its settings cannot be changed; parameters, values will not be saved, and factory default settings cannot be reloaded.

8. Programmer's reference

8.1. LW3 protocol – Overview

Lightware 3 (LW3) protocol is currently used by MODEX extender family, 25G product line and will be the preferred protocol in new developments.

LW3 is an ASCII based protocol and all commands are terminated with a carriage return (Cr, '\r') and line feed (Lf, '\n') pair. It is organized as a tree structure that provides outstanding flexibility for implementing a human readable, but still easy to programmatically parse protocol, which is suitable for different products with different feature list.

The concept

In order to implement a flexible, easy-to-use protocol that is straightforward to adapt to new devices and provides outstanding scalability and sustainability, Lightware decided to organize all settings, parameters and properties of the device to a tree structure with 'nodes', 'properties' and 'methods'.

8.1.1. Elements of tree structure

Info: All names and values are case sensitive. Space character is replaced by '•' character in elements and commands descriptions.

Node

- Basic building block of the tree structure is the 'node'.
- A node can have multiple child nodes, but only one parent.
- The tree has only one root: the 'root node'.
- The leaves of the tree are also nodes, which do not have child nodes.
- Nodes are separated by a slash ('/') character; no backslash is used.
- The identifier of the root node is a slash ('/').
- Nodes' name can contain elements of the English alphabet and numbers.
- The path of a node has to contain all parent nodes from the root node.

Format (the root node): nX•/

Path: nX•/[nodeName]/[nodeName]/[nodeName]

Legend: 'n': node

'X' can be:

- '-': default for a node,
- 'm': manual for the node (see section [8.2.9](#) on page [66](#)),
- 'E': error message for the node (see section [8.1.3](#) on page [61](#)).

Info: All parent nodes must be listed in the path of a node.

Following example presents the depth tree traversal of [Figure 8-1](#):

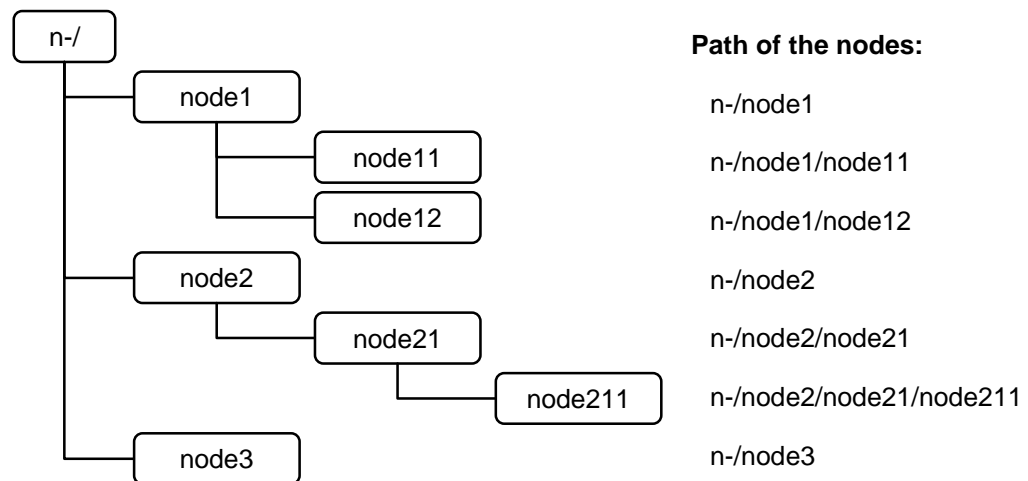


Figure 8-1. Tree structure of nodes

Property

The 'property' in the LW3 protocol is basically a leaf, which has a well-defined value.

- A property has a value.
- A property cannot have child nodes or child properties. It is always a leaf.
- A node can have any number of properties (may not have any).
- A property is referenced with a dot ('.') after the node name.
- The properties' name can contain the elements of the English alphabet, numbers and underscore ('_') character.
- By convention, properties are beginning with capital letter, all other characters are lowercase ones. In case of compound words, all words are beginning with a capital letter (CamelCase).
- The value of the property can contain any readable ASCII character (the control characters have to be escaped, see section [8.1.2](#) on page [60](#)).
- A property can be read-only or read/write.

Format: pX●/[nodeName].[propertyName]=[propertyValue]

Legend: p: property

X can be:

- 'r': if the property is read-only.
- 'w': if the property is readable, writable.
- 'm': manual for the property (see section [8.2.9](#) on page [66](#)).
- 'E': error message for the property (see section [8.1.3](#) on page [61](#)).

Example:

First one is a read-only property, second one is a read-write property:

```

< pr●/SYS/CORE.PartNumber=91610103
< pw●/SYS/CORE.DeviceLabel=MODEX-F15-OPTS
  
```

Method

'Method' in the LW3 protocol is also a leaf. It cannot have a value, such as the properties, but it can be invoked with a parameter with the help of a special 'CALL' command (see section [8.2.5](#) on page [64](#)).

- A method cannot have child nodes or child methods. It is always a leaf.
- A node can have any number of methods (may not have any).
- A method is referenced with a colon (':') after the node.
- Methods' name can contain the elements of the English alphabet, numbers and underscore ('_') character.
- By convention, methods are beginning with lowercase letter. In case of compound words, the very first letter is lowercase, and the first letter of each other words are capitalized (lowerCamelCase).
- The parameter of the method can contain any readable ASCII character (control characters have to be escaped, see section [8.1.2](#) on page [60](#)).
- The method always has a return 'state' if the method could be executed. The state could be either 'OK' or 'FAILED'.
- The method not necessarily has a return 'value'. If it does, it can contain additional information, which is always specific for the current case (return value can specify why the execution failed). Find details in section [8.2.5](#) on page [64](#).
- When the method cannot be executed (e.g. the parameter list is illegal), there is an error message (see section [8.1.3](#) on page [61](#)).

Format: mX●/[nodeName]:[methodName]=[returnValue]

Legend: m: method

X can be:

- 'O': when the execution of the method was successful,
- 'F': when the execution of the method failed,
- 'm': manual for the method (see section [8.2.9](#) on page [66](#)),
- 'E': error message for the method (see section [8.1.3](#) on page [61](#)).

Example:

```
< mO●/node1/node12:method1
< mO●/MEDIA/IR/XPl:DefaultSwitch
< mO●/EDID>DeleteEdid
```

8.1.2. Escaping

Property values and method parameters can contain characters that are used as control characters in the protocol. They must be escaped. The escape character is the backslash ('\') and escaping means injecting a backslash before the character that should be escaped (like in C language).

Control characters are the followings: \ { } # % () \r \n \t

Example:

Original text: John●(Doe) .●#3:●5%2=1●node1\node11

Escaped text: John●\ (Doe\) .●\#3:●5\%2=1●node1\\node11

8.1.3. Error messages

There are several error messages defined in LW3 protocol. All of them have a unique error number which can be used programmatically, and an informative error message.

Format: XE•[primitive]•%EYYYY:•[Error message]

Legend: X can be:

- '-': syntax error. Cannot parse the command at all.
- 'n': node error.
- 'p': property error.
- 'm': method error.

YYY: error code, which can be one of the followings:

| | | | |
|------|----------------------------|------|-------------------------|
| E001 | Syntax error | E010 | Illegal parameter count |
| E002 | Node not found | E011 | Item already exist |
| E003 | EOL expected | E012 | Item does not exist |
| E004 | Writing read-only property | E013 | Illegal operation |
| E005 | Invalid value | E014 | Internal error |
| E006 | Property does not exist | E015 | Access denied |
| E007 | Syntax error | E016 | Write access denied |
| E008 | Illegal method | E017 | Reserved |
| E009 | Method does not exist | E018 | Waiting timeout |

8.1.4. Prefix summary

The following prefixes are defined in LW3 protocol:

- 'n-': a node,
- 'nE': an error for a node,
- 'nm': a manual for a node,
- 'pr': a read-only property,
- 'pw': read-write property,
- 'pE': an error for the property,
- 'pm': a manual for the property,
- 'm-': a method,
- 'mO': a response after a success method execution,
- 'mF': a response after a failed method execution,
- 'mE': an error for a method,
- 'mm': a manual for a method.

8.2. Commands

Getter

The 'GET' command can be used to get subnodes, properties and methods of a specific node. It also can be used to get the value of a property.

Response format

The first two characters of a response are unambiguously identifies the type of the element that the response line concerns. First character is the type of the element (node/property/method), second is for miscellaneous information (e.g. read/write rights).

Defined prefixes are:

'n-': node
'pr': property – only readable
'pw': property – writable, readable
'm-': method executable

After prefix the response contains the full path of the node, property or method after a space character.

8.2.1. Get all children of a node

Get all of the child nodes of a parent node, with one GET command.

Command format: GET•[nodePath]

Response format: n-•[nodePath]

Example:

```
> GET•/MEDIA/IR
< n-•/MEDIA/IR/XP1
< n-•/MEDIA/IR/P1
< n-•/MEDIA/IR/P2
```

8.2.2. Get all properties and methods of a node

Get all properties and methods of a specific node, with one GET command, using an asterisk wildchar.

Command format: GET•[nodePath].*

Response format: (for properties)

pX•[nodePath].[propertyName]=[parameter]

Legend: X can be:

'r': read-only
'w': read-write

Response format: (for methods)

m-•[nodePath]:[methodName]

Example:

```
> GET•/PRESETS/1.*
< pr•/PRESETS/1.Index=1
< pw•/PRESETS/1.RemoveLock=false
< pw•/PRESETS/1.Text=Preset 1
```

8.2.3. Get all child nodes, properties and methods of a node

Get all child nodes, properties and methods of a node with one command, without using a wildchar.

Command format: GETALL●[nodePath]

Response format: (for nodes)

n-●[nodePath]

Response format: (for properties)

pX●[nodePath].[propertyName]=[parameter]

Legend: X can be:

'r': read-only

'w': read-write

Response format: (for methods)

m-●[nodePath]:[methodName]

Example:

```
> GETALL●/MANAGEMENT
< n-●/MANAGEMENT/NETWORK
< n-●/MANAGEMENT/STATUS
< n-●/MANAGEMENT/LOCK
< n-●/MANAGEMENT/LOG
< pr●/MANAGEMENT.rebootNeeded=false
< pw●/MANAGEMENT.WebEnvironment=
< m-●/MANAGEMENT:Udc
< m-●/MANAGEMENT:Msg
```

Info: The command does not list child nodes and properties of listed child nodes, only that belongs to the node directly. E.g. the child nodes and properties of /MANAGEMENT/NETWORK is not listed in this example, those can be queried if 'GETALL●/MANAGEMENT/NETWORK' is run.

8.2.4. Set command

The setter command can be used to modify the value of a property.

Command format: SET●[nodePath].[propertyName]=[newPropertyValue]

Response format:

The response for setting a property to a new value is the same as the response for 'GET' command. The value in the response is the new value if the execution of 'SET' command was successful, otherwise the unmodified 'old value' with an error message.

pw●[nodePath].[propertyName]=[newPropertyValue]

Example:

```
> SET●/MANAGEMENT/NETWORK.PortNumber=6107
< pw●/MANAGEMENT/NETWORK.PortNumber=6107
```

Error response format:

If there were errors during setting a property, an error message follows the unmodified property value. Find the error numbers in section [8.1.3](#) on page [61](#).

pE●[nodePath].[propertyName]=[unmodifiedValue]●%EXXX:Error message

Legend:

XXX: error number (see section [8.1.3](#) on page [61](#)).

Examples:

```
> SET●/SYS/CORE/B/VIDEODV000.HdcpEnable=false
< nE●%E002:Node not found
> SET●/SYS/CORE.PartNumber=12345678
< pE●%E004:Writing read-only property
> SET●/SYS/CORE/B/VIDEODVI.HdcpEnable=falssss
< pE●%E005:Invalid value
> SET●/SYS/CORE/B/VIDEODVI.HdcpEnab=false
< pE●%E006:Property not exists
```

8.2.5. Invocation

A method can be invoked with the help of 'CALL' command.

Command format: CALL●[nodePath]:[methodName]([parameter])

Response format:

The response for a method execution is a state and a value. The state is mandatory and always defined, if the method could be executed. It can be either a success or a failure. The value is optional and it can contain additional information – such as the reason why the state is a failure or a specific value when the state is success – which the client can process. It is also possible to get an error message, when the method could not be executed – e.g. the parameter was illegal – and hence not even the state of the execution could be specified.

mX●[nodePath]:[methodName]=Y

Legend: X can be:

- 'O': if the execution is successful.
- 'F': if the execution is failed, but the method could be executed.
- 'E': if the method could not be executed: e.g. illegal parameter count.

Y can be:

- the return value of the method if any.
- it is valid that a method does not have any return value. In this case the equal sign ('=') can be omitted.

Example:

```
> CALL●/MANAGEMENT/LOCK:LockAll ()
< mO●/MANAGEMENT/LOCK:LockAll
```

Error response format:

If there were errors during the execution, an error message is received, which follows the method name. Find the error numbers in section [8.1.3](#) on page [61](#).

mE●[nodePath]:[methodName]●%EXXX:Error message

Example:

```
> CALL●/EDID>DeleteEdid(U100)
< mE●%E005:Invalid●value
```

8.2.6. Subscription

User can subscribe to any node. Subscribe to a node means that user will get a notification if any of the properties of the node is changed. These notifications are asynchronous messages – such as the ones described above – and hence they are useful to keep client application up-to-date, without receiving any unwanted information. When user does not want to be informed about the changes anymore, he can simply unsubscribe from the node.

Info: The subscriptions are handled separately for connections and not for users. Hence, if the connection is terminated all registered subscriptions are deleted. After every connection the subscribe command has to be sent in order to get the notifications of the changes.

Subscribe to a node

Command format: OPEN●[nodePath]

Response format: o-●[nodePath]

Example:

```
> OPEN●/MANAGEMENT/NETWORK
< o-●/MANAGEMENT/NETWORK
```

Subscribe to multiple nodes

In order to subscribe to multiple nodes, asterisk wildchar can be used.

Command format: OPEN●[nodePath]/*

Response format: o-●[nodePath]/*

Example:

```
> OPEN●/MANAGEMENT/LOG/*
< o-●/MANAGEMENT/LOG/*
```

Get the active subscriptions

Issuing an 'OPEN' command without any parameters returns the active subscriptions for the current connection.

Command format: OPEN

Response format: o-●[nodePath]

Example:

```
> OPEN
< o-●/SYS/CORE
< o-●/MEDIA/VIDEO
< o-●/MEDIA/AUDIO
< o-●/MEDIA/IR
< o-●/MEDIA/UART
```

Unsubscribe from a node

Command format: CLOSE●[nodePath]

Response format: c-●[nodePath]

Example:

```
> CLOSE●/MANAGEMENT/LOCK
< c-●/MANAGEMENT/LOCK
```

Unsubscribe from multiple nodes

In order to unsubscribe from multiple nodes, asterisk wildchar can be used.

Command format: CLOSE●[nodePath]/*

Response format: c-●[nodePath]/*

Example:

```
> CLOSE●/MANAGEMENT/*
< c-●/MANAGEMENT/*
```

8.2.7. Notifications about the changes of the properties

When the value of a property is changed and the user is subscribed to the node, which the property belongs to, an asynchronous notification is generated. This notification is called as the 'change message'. The format of such a message is very similar to the response for 'GET' command.

Format: CHG●[nodePath].[propertyName]=[newPropertyValue]

Example:

```
CHG●/MEDIA/IR.P1=IR Input
```

8.2.8. Signature

For some command the response can contain multiple lines. Every line is terminated with a carriage return (Cr, '\r') and line feed (Lf, '\n') characters. In several cases the number of the lines in the response cannot be determined in advance. In several cases the client is intended waiting for the whole response and also wants to be sure, that received lines belong together and to the same command. In these cases a special feature the 'signature' can be used.

The signature is a four-digit-long hexadecimal value that can be optionally placed before every command. In that case, the response to that particular command will also be preceded by the signature, and the corresponding lines will be in between brackets.

Command format: XXXX#[command]

Legend: xxxx: four-digit-long hexadecimal value.

Response format:

```
{XXXX
```

```
[command lines]
```

```
}
```

Example:

```
> 0001#GET●/MEDIA
< {0001
< n-●/MEDIA/VIDEO
< n-●/MEDIA/AUDIO
< n-●/MEDIA/UART
< n-●/MEDIA/IR
< n-●/MEDIA/PACKETROUTER
< }
```

Info: The lines of the signature are also Cr and Lf terminated.

8.2.9. Manual

For every property and method in the tree there is a manual. The manual is a human readable text that describes the syntax and provides a hint for how to use the primitives.

Command format:

for property: MAN●[nodePath].[propertyName]

for method: MAN●[nodePath]:[methodName]

Response format:

The human readable manual is separated by a space (' ') character from the primitives.

for properties: pm●[nodePath].[propertyName]●Human readable manual

for methods: mm●[nodePath]:[methodName]●Human readable manual

Example:

```
> MAN●/PRESETS.Count  
< pm●/PRESETS.Count:[int] Number of presets  
> MAN●/SYS/CORE:ResetLink  
< mm●/SYS/CORE:ResetLink:Reset optical link.
```

8.3. LW3 protocol tree

The tree structure of each MODEX is the following:

/ (root node)

/REMOTE (if remote device is connected)

/PRESETS

/MANAGEMENT

/EDID

/MEDIA

/SYS

8.3.1. /REMOTE

The node contains the protocol tree of the remote device (if connected): PRESETS, MANAGEMENT, EDID, MEDIA and SYS subnodes. Settings and values are valid for the remote device only.

8.3.2. /PRESETS

Group node for the eight available presets; each preset has own subnode with its properties.

8.3.3. /MANAGEMENT/

A group node for every management related settings. The features and settings here are not related to the current crosspoint settings. The node contains the following subnodes:

/MANAGEMENT/NETWORK

Contains Network-related properties, such as IP address, Gateway, Subnet mask, DHCP and Port settings.

/MANAGEMENT/STATUS

Basic status values are stored about the MODEX: Firmware versions, Internal Voltage values, Module code, System time (elapsed time since last booting in seconds).

/MANAGEMENT/LOCK

Installed modules can be locked/unlocked individually or together.

Info: The locking state is also stored under /SYS/CORE nodes and its subnodes (as read-only property), but the settings can be done in /MANAGEMENT/LOCK.

/MANAGEMENT/LOG

Last logged events can be queried here. /MANAGEMENT/LOG node contains five properties (Warning, Error, Debug, Fatal and Notice), which shows the number of the occurrence of the given event type. The log can be emptied by the calling the *clearLog* method.

The node has five subnodes (NOTICE, WARNING, ERROR, FATAL, DEBUG) which contain the log entries as a property describing the logged event with details.

8.3.4. /EDID

The node and its subnodes represent all information about EDID management. The node contains basic methods in connection with EDID emulation such as Copy, Delete or Emulate EDID. Subnodes refer to the type of the EDID as follows:

- F: Factory EDIDs,
- U: User EDID,
- D: Dynamic EDID (The EDID of the monitor last attached to the receiver),
- E: Emulated EDID (List of assigned video ports).

The node structure of Factory, User and Dynamic EDIDs contain the available EDIDs as subnodes. The structure of these EDID subnodes is the same:

- Header: *Valid/Invalid* (based on EDID header)
- Data: *EDID data* – in HEX format
- IsValid: *True/False* – (based on EDID data)

For detailed information about EDID memory see section [4.3](#) on page [23](#).

8.3.5. /MEDIA

MEDIA node contains the available layers on installed modules, such as VIDEO, AUDIO, UART or IR module. Port and Crosspoint settings are structured in subnodes with methods and properties in the nodes of the layers.

8.3.6. /SYS

The node has two subnodes: LOG and CORE.

/SYS/LOG

Last log events collected from last booting. The structure is the same as for /MANAGEMENT/LOG.

/SYS/CORE

The node contains properties of MODEX frame; nevertheless its subnodes contain the installed modules (B, C, D and E). Signal parameters are listed in the subnodes.

9. Firmware upgrade

MODEX can be upgraded by connecting a Windows PC via LAN and using Lightware's Universal Platform Bootloader Software (UPBSW). The application can be downloaded from www.lightware.eu. In order to get the firmware pack with the necessary components (*.lfp file) for your specific product, please contact support@lightware.eu. UPBSW can be installed to a Windows PC.

Info: While the firmware is being upgraded, normal operation mode is suspended as the extender is switched to bootload mode. Signal processing between the extenders is not performed. Do not interrupt the firmware upgrade. If any problem occurs, switch off the extender and restart the process.

Info: User EDID memory or settings are not modified/erased during the upgrade.

Important! Always upgrade both extenders of a MODEX pair: if you upgrade the transmitter, use the same firmware package also on the receiver. More devices can be upgraded at the same time: in this case connect them to the LAN via Ethernet and make sure they are not connected to each other by fiber optical cable.

9.1. Short instructions

- Step 1.** Get the firmware pack and the Universal Platform Bootloader (UPBSW) application.
- Step 2.** Install the UPBSW application.
- Step 3.** Connect the computer to the MODEX device(s).
- Step 4.** Start the UPBSW and follow the instructions shown on the screen.

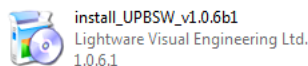
9.2. Detailed instructions

9.2.1. Get the firmware pack and the UPBSW application

In order to get the firmware pack with the necessary components (*.lfp file) for your device(s), please contact support@lightware.eu. The UPBSW application can be downloaded from www.lightware.eu.

9.2.2. Install the UPBSW application

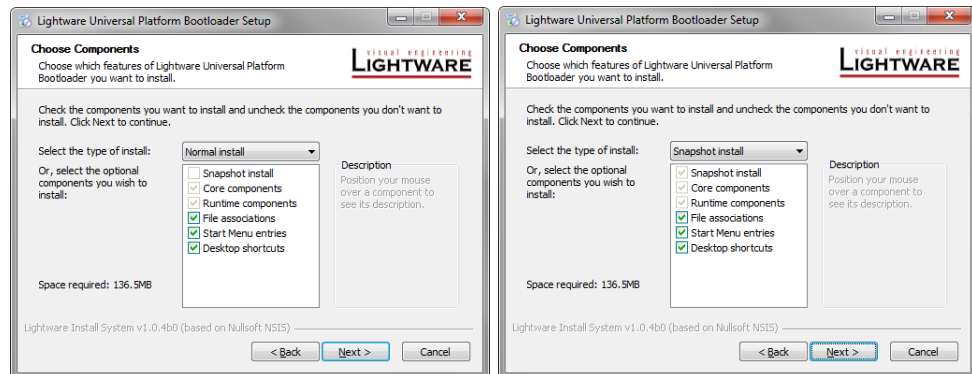
- Step 1.** Run install_UPBSW_v1.0.6b1.exe.



- Step 2.** Click Next in the opening Welcome window.

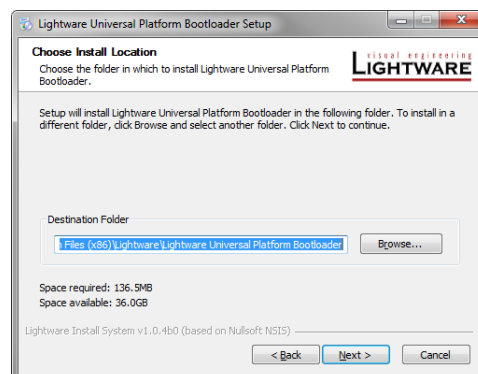


Step 3. Select the type of the installation. Here can be chosen the normal and the snapshot install. Select the optional components then click Next. (Using the Normal install as the default value is highly recommended.)

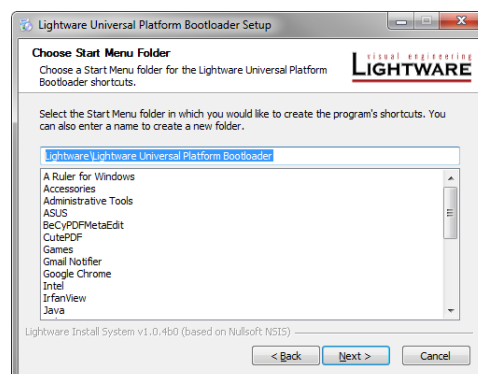


| Normal install (recommended) | Snapshot install |
|---|---|
| The installer can update only this instance. | Cannot be updated. |
| One only updateable instance can exist for all users. | More than one different version can be installed for all users. |
| Does not contain the version in its name. | Version number is displayed in the name. |

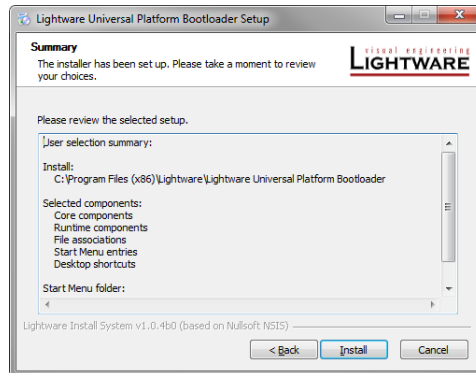
Step 4. Select the destination folder and click Next. (Using the default path is highly recommended.)



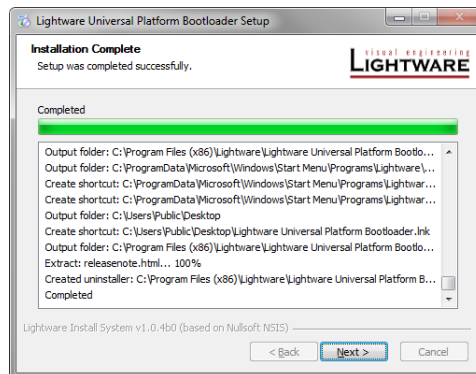
Step 5. Select the Start menu folder and click Next. (Using the default folder is highly recommended. If the Start menu entries was not checked in the Step 2, this window will be skipped.)



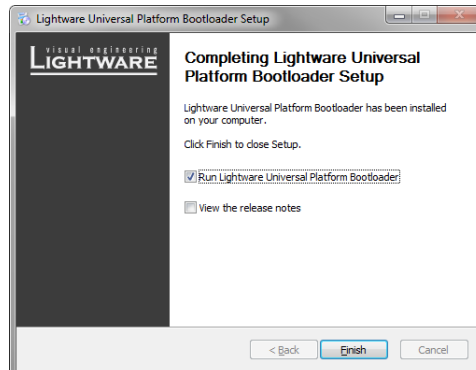
Step 6. Verify the settings and click Install, or click Back and change the settings.



Step 7. After the installation of the last component the Next button is activated – click on it.




Step 8. If the installation is complete, click Finish.

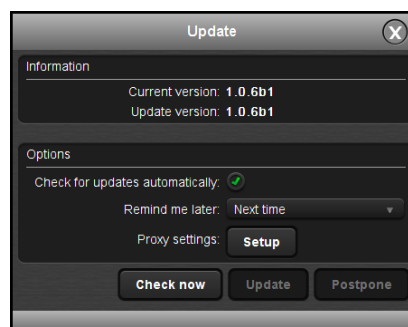
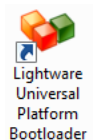


Upgrade the UPBSW

Step 1. Run the application.

Step 2. In the welcome screen click on the  button in the top right corner – the About window will appear. Click on the Update button.

Step 3. The program checks the available updates on Lightware website and shows its version. Set the desired update settings in the Options section.

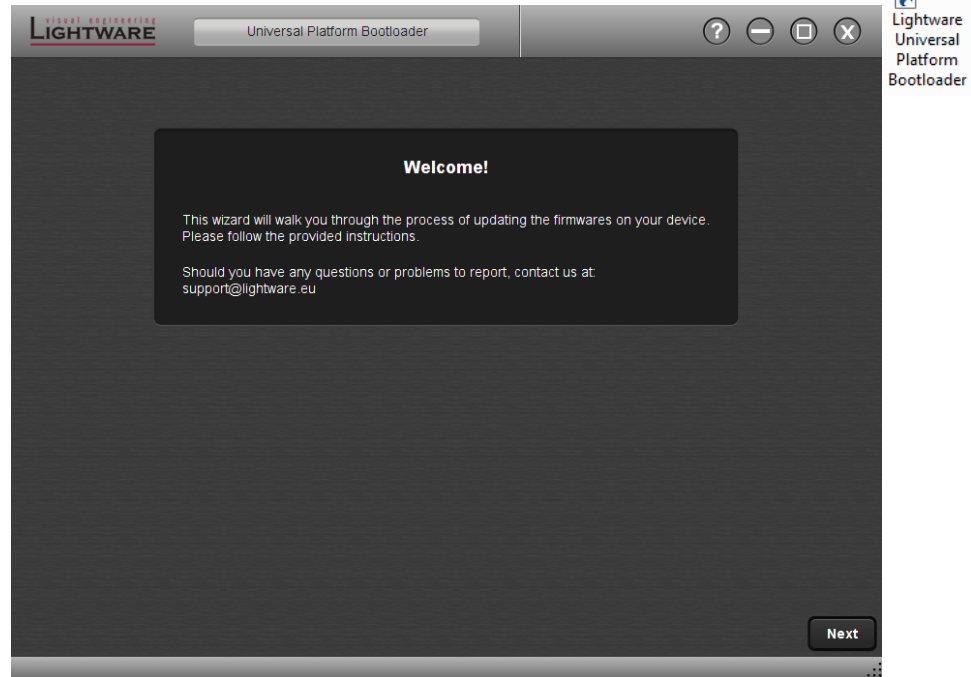


9.2.3. Connect the computer to the MODEX device(s)

Make sure that the computer and the MODEX are connected and the connection is established either by a patch cable via LAN, or directly by a cross-link cable.

Important! Do not connect more than one port of a MODEX to the same LAN to avoid loops. In the same way, if you want to upgrade the firmware of a transmitter and a receiver, connect both to the LAN, but make sure they are not connected via fiber optical cable.

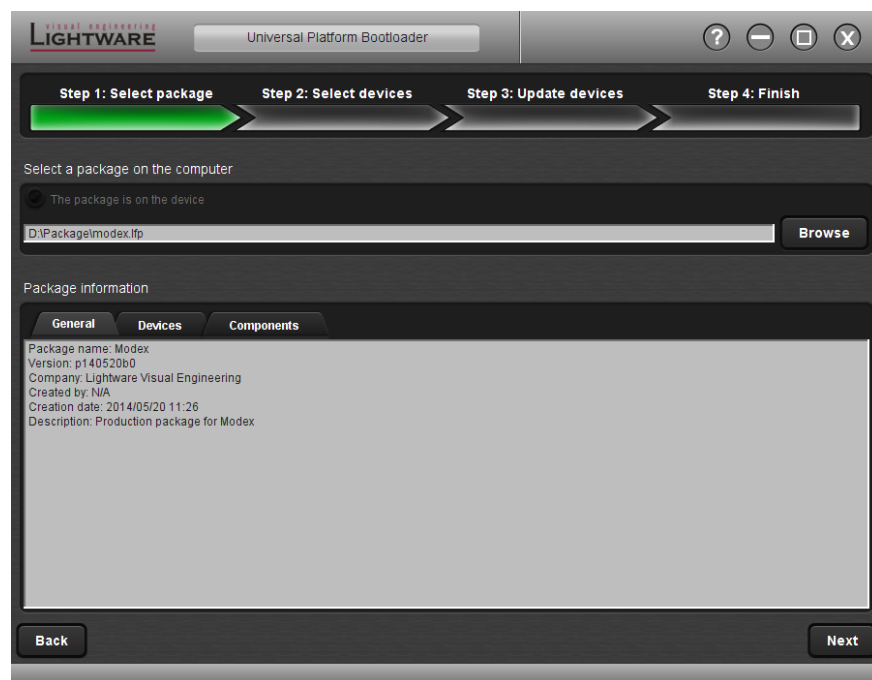
9.2.4. Start the UPBSW and follow the instructions shown on the screen



The welcome screen will appear, click on Next button.

Step 1. Select package

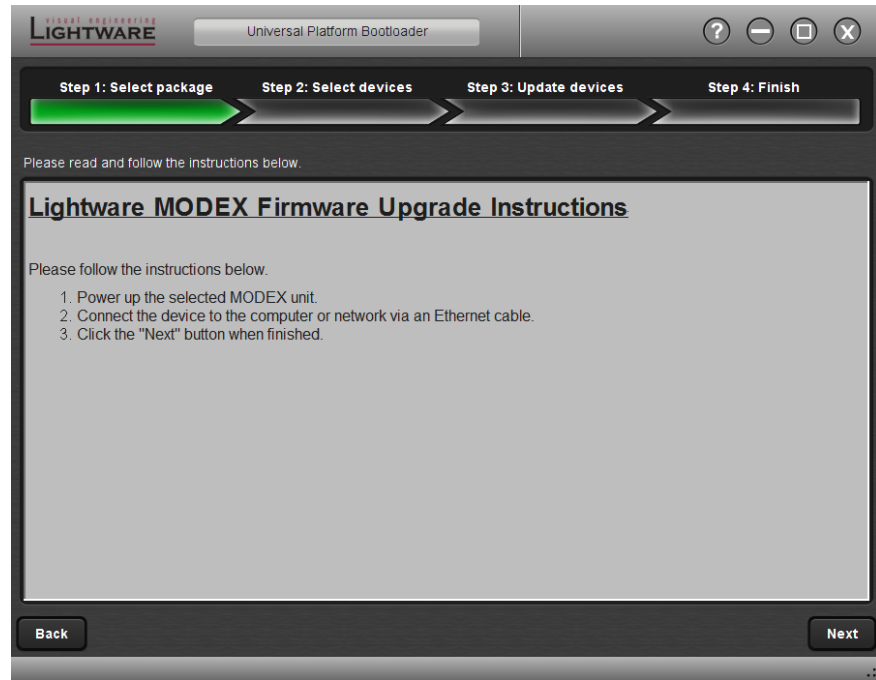
Select the package (*.lfp file) on the computer that will be used for the upgrading. Click on Browse button and select the file.



Package information will be loaded to the tabs:

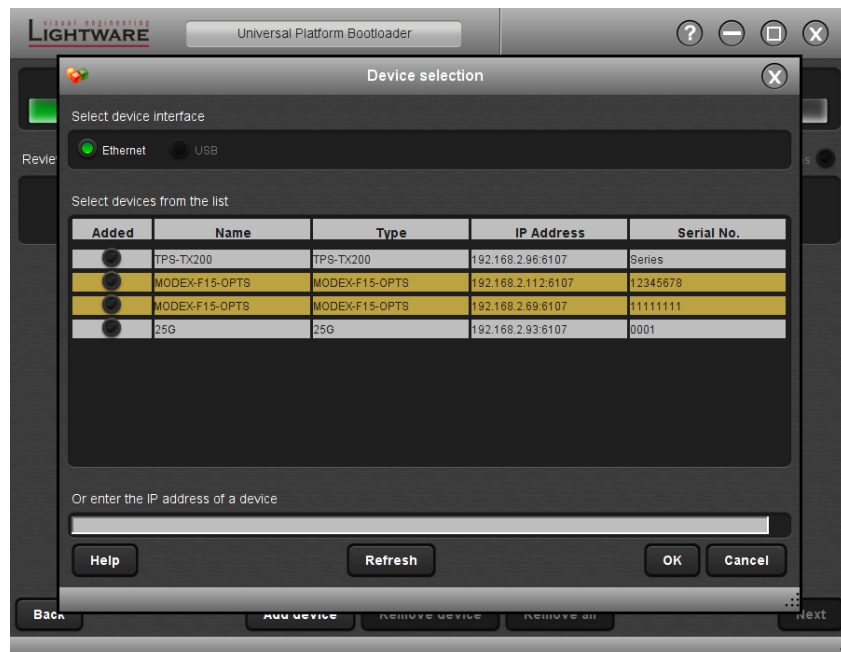
- **General** version info, creation date, short description,
- **Devices** which are compatible with the firmware,
- **Components** in the package with release notes.

Click on Next button and follow the instructions below:



Info: Files with “.lfp” extension are associated to UPBSW during installation. If you double click on the “.lfp” file, the application is launched and the package is loaded automatically. In this case you will see above screen.

Step 2. Select devices



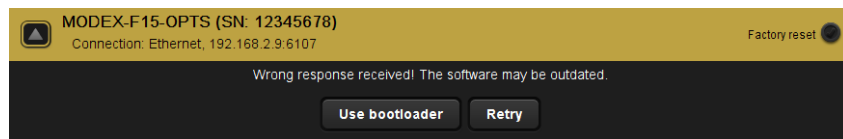
The following step is to select the device(s) which will be updated. The available and supported devices are searched and listed automatically; currently, UPBSW is able to update the firmware of devices connected via Ethernet or USB port. MODEX can be updated via Ethernet. If the desired device is not listed, update the list by clicking the Refresh button and/or type its IP address in the line.

Select the desired devices: highlight them with yellow cursor, then click OK.

The firmware components of the devices are listed on the following screen; their version and the one that is available in the browsed package. Update versions will be uploaded into the device(s).

*Info: The media connector code of the MODEX is replaced by ***, since it has no importance from firmware upgrade point of view.*

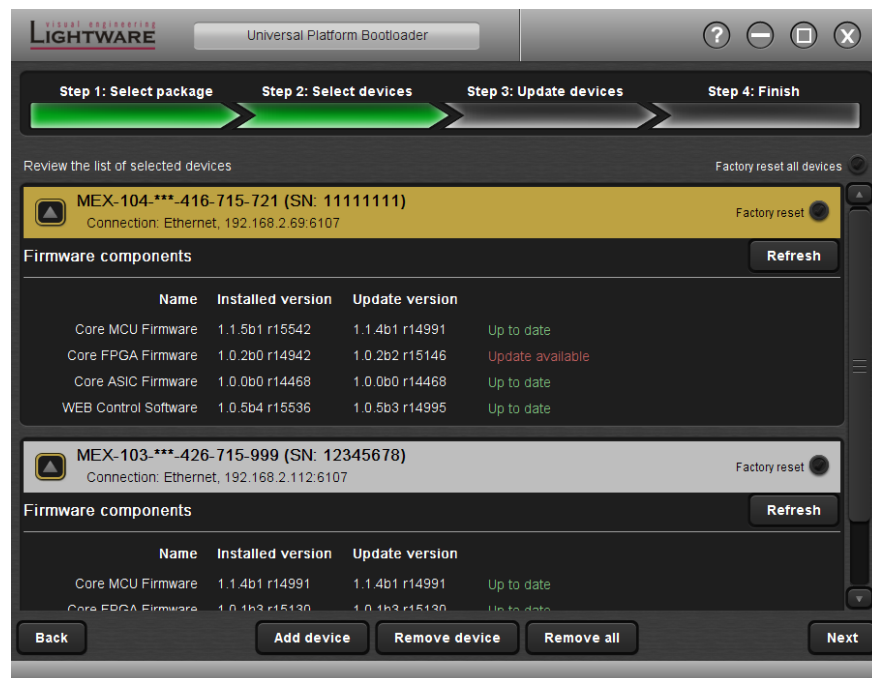
Info: If MODEX cannot send the details about its firmware, click on the Use Bootloader button:



Add a device by clicking on the Add device button. The previous screen will be shown; devices, what have already been added are marked in the first column. Select the desired device(s) and click on OK.

Remove a device by selecting it (highlight with yellow) and click on Remove device button; or click on Remove all button to empty the list.

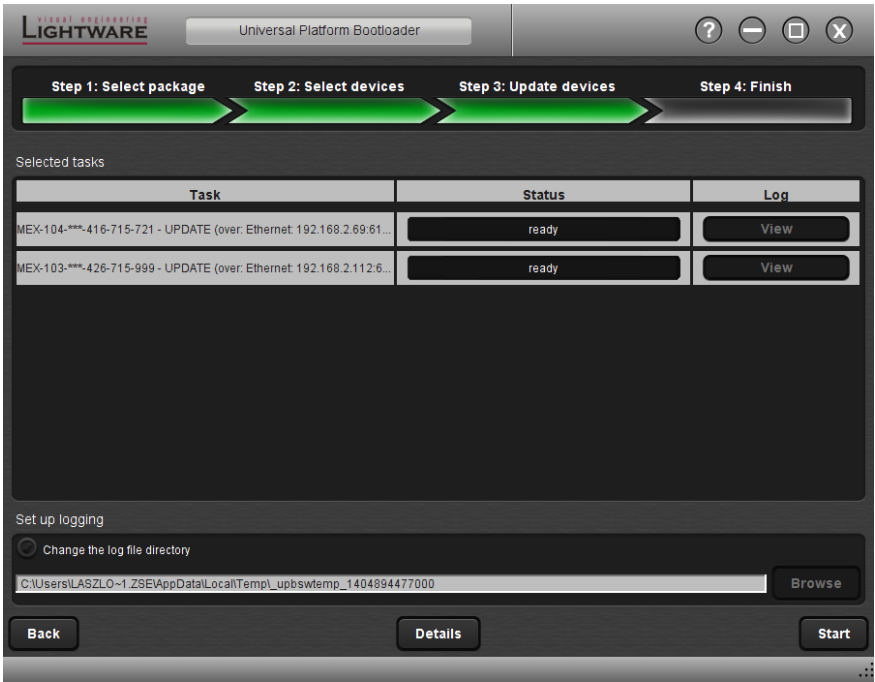
Factory reset can be also executed by ticking the option on the right. The settings has the same effect as resetting the device from front panel.



Click on Next button to step forward.

Step 3. Update devices

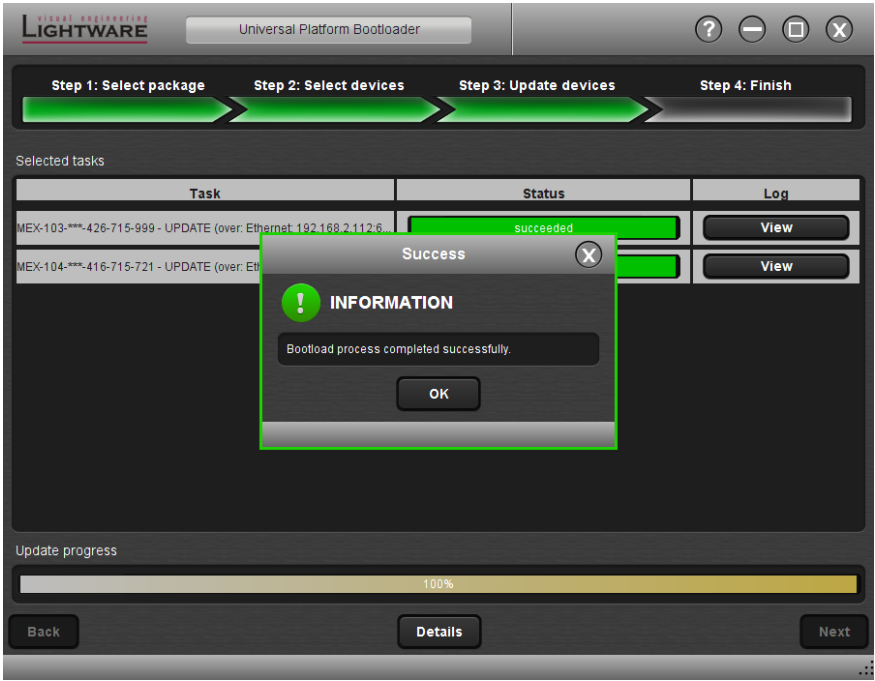
The selected devices are listed with their status. The setup is logged automatically; the default path can be changed by ticking the option and browsing a folder.



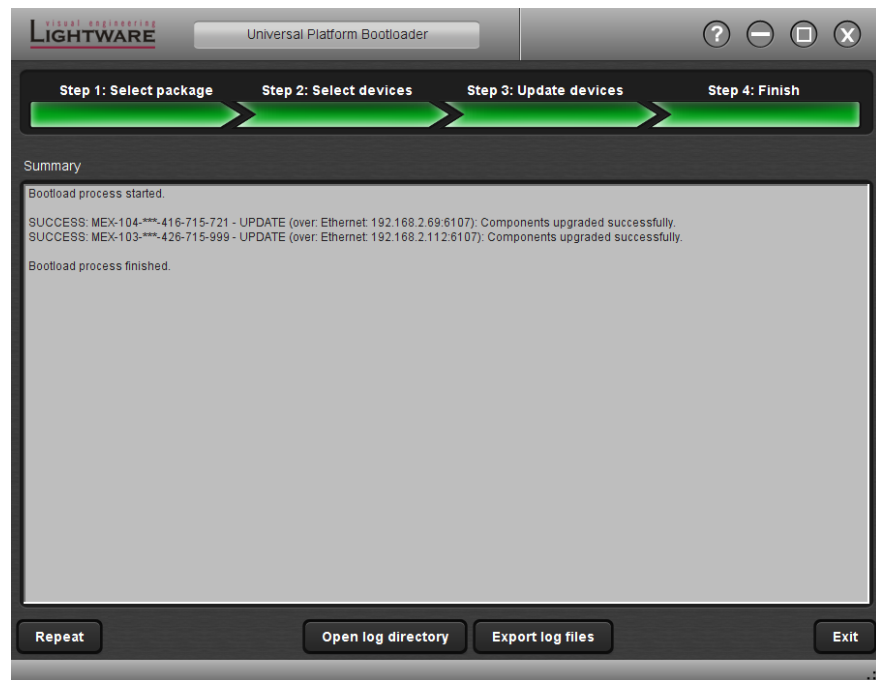
Start button begins the upgrade process.

Details button opens a new window that displays the process.

If the upgrade of a device is finished, its log can be opened by the View button on the right. When all the tasks are finished, a windows appears. Click OK to close and Next to display the summary page.



Step 4. Finish



Repeat button starts the process again with the selected device(s).

Open log directory shows the temporary folder where the logs can be found.

Export log files by saving them as a zipped file.

Press **Exit** to close the program.

Info: However the devices are rebooted after the firmware upgrade, switching off and on again is recommended.

Info: If the upgrade is failed, restart the device(s) and repeat the process.

10. Specifications

10.1. Media connectors

10.1.1. MODEX-OPTS and MODEX-OPTM

Connectors

| | |
|-----------------------------|------------------------------|
| Fiber | Neutrik opticalCON connector |
| Ethernet | RJ45 connector |
| USB KVM (transmitter) | 1 x USB-B female connector |
| USB KVM (receiver)..... | 2 x USB-A female connector |
| Power | IEC 110-230V |

Control

| | |
|------------------------------------|---|
| Front panel buttons | Yes |
| Front panel LCD..... | Yes, 2 x 16 characters |
| Web..... | Built-in website (TCP/IP Ethernet) |
| EDID management (transmitter) | 119 factory and 31 user programmable EDID |
| EDID emulation..... | 256-Byte Extended EDID v1.3 |

Fiber specifications

| | |
|--------------------------------------|----------------------|
| Link speed..... | 6.25 Gbps |
| Single mode fiber wavelength..... | 1310, 1490, 1550 nm |
| Multimode fiber wavelength | 850, 1310, 1550 nm |
| Single mode extension distance | 10 km (32800 ft) |
| Multimode extension distance | 300 m (1000 ft) |
| Optical transmission channel 1 | OPTS/OPTM connection |
| Optical transmission channel 2 | currently not in use |

Video specifications

| | |
|-----------------------------------|--|
| Supported video resolutions | Up to 4K (24 Hz, 4:2:2, 297 MHz, 24 bit) |
| Max pixel clock..... | 297 MHz |
| Frame delay | No delay |
| Video signal latency | Approx. 3 lines |

Audio specification

| | |
|-----------------------|---------------------------------|
| Embedded audio* | 8 channel PCM or HBR compressed |
| Return AUX..... | 4 channel PCM or 5.1 compressed |
| Forward audio | 2 channel PCM or 5.1 compressed |
| Return audio | 2 channel PCM or 5.1 compressed |

* The embedded audio in the video stream can be switched to any other audio

Ethernet specification

| | |
|----------------|---------------|
| Ethernet | 10/100 Mbit/s |
|----------------|---------------|

USB specifications

| | |
|---------------------|------------------------------|
| USB standards | Only HID devices, Smart Card |
| USB HUB | Not supported |
| Device number | 2xUSB HID devices |

General

| | |
|-----------------------------|--|
| Dimensions | 221 W x 240 D x 42.5 H mm |
| Weight | 2 kg (excluding all modules) |
| Power consumption | 7.5 W (typical), 9.6 W (max) without modules 15 W (typical) 25 W (max) with modules |
| ESD protection | ±8 kV HBM |
| Operation temperature | 0°C to +70°C |
| Storage temperature | -20°C to +85°C |
| Humidity | 10% to 90% non-condensing |
| Compliance | CE |
| Warranty | 3 years |

10.2. Video & Audio modules

10.2.1. MODEX-AV-DVIDL-IM

| | |
|-------------------------------------|-------------------------------|
| Part number | 9161 0401 |
| Max resolution | 2560x1600@60Hz |
| Color depth | 8 bit per color |
| Color space | RGB |
| Frame delay | No delay |
| Data rate | Total max 9.9 Gbps |
| Max pixel clock | 165 MHz |
| Supported video formats | DVI 1.0 |
| 3D support | Yes |
| Embedded audio / Return audio | No / No |
| EDID emulation | Yes, Advanced EDID management |
| HDCP compliancy | Yes |
| Audio capability | Not supported |
| Weight | 100 g |
| Power consumption | 1.4W (typ), 2W (max) |
| Connectors | DVI-D |
| ESD protection | ±8kV HBM |

10.2.2. MODEX-AV-DVIDL-OM

| | |
|-------------------------------------|-------------------------------|
| Part number | 9161 0404 |
| Max resolution..... | 2560x1600@60Hz |
| Color depth | 8 bit per color |
| Color space | RGB |
| Frame delay | No delay |
| Data rate | Total max 9.9 Gbps |
| Max pixel clock..... | 165 MHz |
| Supported video formats..... | DVI 1.0 |
| 3D support | Yes |
| Embedded audio / Return audio | No / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | Not supported |
| Weight..... | 100 g |
| Power consumption | 3.5W (typ), 3.5W (max) |
| Connectors..... | DVI-D |
| ESD protection..... | ±8kV HBM |

10.2.3. MODEX-AV-HDMI-DVI-IM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0407 |
| Max resolution..... | 1920x1200@36 bit |
| | 1600x1200@24 bit |
| Max (in/out) cable length | 30 m |
| Color depth | 36 bit (12 bit per color) |
| Color space | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | Total max 6.75 Gbps |
| Max pixel clock..... | 225 MHz |
| Supported video formats..... | DVI 1.0, HDMI 1.3a |
| 3D support | No |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | 4 stereo PCM or HBP compressed |
| Weight..... | 105 g |
| Power consumption | 1.3 W (typ) 2.2 W (max) |
| Connectors..... | DVI-D, HDMI |
| ESD protection..... | ±8 kV HBM |

10.2.1. MODEX-AV-HDMI-DVI-4K-IM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0410 |
| Max resolution..... | 1600x1200@60Hz, 36 bit |
| | 3840x2160@30Hz, 24 bit |
| Max cable length..... | 30 m |
| Color depth | 24, 30, 36 bit |
| Color space..... | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | 9 Gbps |
| Max pixel clock..... | 300 MHz |
| Supported video formats..... | DVI 1.1, HDMI 1.4 |
| 3D support | Yes |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | 4 stereo PCM or HBR compressed |
| Weight..... | 105 g |
| Power consumption | 2.75W (max) |
| Connectors..... | DVI-D, HDMI |
| ESD protection..... | ±8kV HBM |

10.2.2. MODEX-AV-HDMI-OM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0413 |
| Max resolution..... | 1920x1200@36bit |
| | 1600x1200@24bit |
| Color depth | 36 bit (12 bit per color) |
| Color space..... | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | Total max 6.75 Gbps |
| Max pixel clock..... | 225 MHz |
| Supported video formats..... | DVI 1.0, HDMI 1.3a |
| 3D support | No |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | 4 stereo PCM or HBP compressed |
| Weight..... | 95 g |
| Power consumption | 0.4 W (typ) 0.7 W (max) |
| Connectors..... | HDMI |
| ESD protection..... | ±8 kV HBM |

10.2.3. MODEX-AV-HDMI-4K-OM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0416 |
| Max resolution..... | 1600x1200 @ 60 Hz 36 bit |
| | 3840x2160 @ 30 Hz 24 bit |
| | 1920x1080p @ 120 Hz 24 bit |
| Color depth | 24, 30, 36 bit deep color |
| Color space | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | 9 Gbps |
| Max pixel clock..... | 300 MHz |
| Supported video formats..... | DVI 1.0, HDMI 1.4 |
| 3D support | Yes |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes, v1.4 |
| Audio capability..... | 4 stereo PCM or HBR compressed |
| Weight..... | 95 g |
| Power consumption | 0.38W (typ), 2.88 W (max) |
| Connectors..... | HDMI |
| ESD protection..... | ±8kV HBM |

10.2.4. MODEX-AV-3GSDI-IM

| | |
|------------------------------|--|
| Part number | 9161 0426 |
| Max resolution..... | 1920x1080p @ 60 Hz |
| | 3G-SDI Level A: 1920x1080p YCbCr 4:2:2 |
| | 3G-SDI Level B: 1920x1080p YCbCr 4:2:2 |
| Max input cable length | 130 m @ 3G-SDI |
| Color depth | 20 bit |
| Color space | 10 bit / Y, 10 bit / CbCr, 12 bit RGB |
| Frame delay | No delay |
| Data rate | Total max 2.97 Gbps |
| Supported video formats..... | SD-SDI, HD-SDI, 3G-SDI |
| 3D support | No |
| Embedded audio..... | Yes |
| EDID emulation..... | No |
| Audio capability..... | 4 stereo PCM |
| Weight..... | 120 g |
| Power consumption | 0.7W (typ), 1.1W (max) |
| Connectors..... | 3xBNC (1x in, 2x loop out) |
| ESD protection..... | ±8kV HBM |

10.2.5. MODEX-AV-DVI-OM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0430 |
| Max resolution..... | 1920x1200@ 36 bit |
| | 1600x1200@ 24 bit |
| Color depth | 36 bit (12 bit per color) |
| Color space..... | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | Total max 6.75 Gbps |
| Max pixel clock..... | 225 MHz |
| Supported video formats..... | DVI 1.0, HDMI 1.3a |
| 3D support | No |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | 4 stereo PCM or HBR compressed |
| Weight..... | 95 g |
| Power consumption | 0.4W (typ), 0.7W (max) |
| Connectors..... | DVI-D |
| ESD protection..... | ±8kV HBM |

10.2.6. MODEX-AV-DVI-IM

| | |
|-------------------------------------|--------------------------------|
| Part number | 9161 0433 |
| Max resolution..... | 1920x1200@ 36 bit |
| | 1600x1200@ 24 bit |
| Color depth | 36 bit (12 bit per color) |
| Color space..... | RGB, YCbCr 4:4:4/4:2:2 |
| Frame delay | No delay |
| Data rate | Total max 6.75 Gbps |
| Max pixel clock..... | 225 MHz |
| Supported video formats..... | DVI 1.0, HDMI 1.3a |
| 3D support | No |
| Embedded audio / Return audio | Yes / No |
| EDID emulation..... | Yes, Advanced EDID management |
| HDCP compliancy..... | Yes |
| Audio capability..... | 4 stereo PCM or HBR compressed |
| Weight..... | 95 g |
| Power consumption | 0.4W (typ), 0.7W (max) |
| Connectors..... | DVI-D |
| ESD protection..... | ±8kV HBM |

10.3. Interface modules

10.3.1. MODEX-IF-RS232

Part number 9161 0712
Supported baud ratefrom 2400 to 256000 (configurable)
Signal type RX/TX bidirectional
Weight..... 60 g
Power consumption0.1 W (typ) 0,2 W (max)
Connector9-pole D-sub
ESD protection.....±15 kV HBM

10.3.2. MODEX-IF-2xRS232

Part number 9161 0713
Supported baud ratefrom 2400 to 256000 (configurable)
Signal type RX/TX bidirectional
Weight..... 70 g
Power consumption0.1 W (typ) 0,2 W (max)
Connector2 x 9-pole D-sub
ESD protection.....±15 kV HBM

10.3.3. MODEX-IF-RS232-RS422

Part number 9161 0714
Weight..... 70 g
Power consumption0.1 W (typ) 0,2 W (max)
Connector2 x 9-pole D-sub
ESD protection.....±15 kV HBM

RS-232

Supported baud ratefrom 2400 to 256000 (configurable)
Signal type RX/TX bidirectional

RS-422

Pin assignment 1: RX-, 2: RX+, 3: TX+, 4: TX-, 5: GND
Signal levels.....±5 V

10.3.4. MODEX-IF-RS232-IR

Part number 9161 0715
 Weight 65 g
 Power consumption 0.1 W (typ) 0.2 W (max)
 IR connector 2x3.5 mm TRS connector (1/8" mini-jack), 9-pole D-sub
 ESD protection No

RS-232

Supported baud rate from 2400 to 256000 (configurable)
 Signal type RX/TX bidirectional

IR

Supported frequencies (input carrier frequency) 38 kHz (configurable)
 Supported frequencies (output carrier frequency) 38 kHz (configurable)

10.3.5. MODEX-IF-ETH

Part number 9161 0718
 Ethernet data rate 10/100Base-T, full duplex with autodetect
 Ethernet protocol ARP, ICMP (ping), IP, TCP, DHCP, HTTP, SMTP, Telnet
 Power over Ethernet Not supported
 Auto-MDIX Yes
 Weight 70 g
 Power consumption 0.05 W (typ) 0,066 W (max)
 Connector 1 x female RJ45
 ESD protection ±8 kV HBM

10.3.6. MODEX-IF-AUDIN

Part number 9161 0719
 Weight 80 g
 Power consumption 0.2 W (typ) 0.33 W (max)
 Connectors 1xRCA, 1x5 pole PHOENIX
 ESD protection ±8kV HBM

S/PDIF digital audio

Audio format S/PDIF
 Supported sample rates 16 to 48 kHz
 AES/EBU compatibility No
 Bit depths Up to 24 bits

Analog audio

Sample frequency 16 to 96 kHz
 Maximum level Input: 4.4 Vp-p
 Frequency response 20 Hz to 20 kHz: ±1 dB
 Gain -5dB to 19dB
 Input impedance 28 kΩ

10.3.7. MODEX-IF-AUDOUT

| | |
|-------------------------|--------------------------|
| Part number | 9161 0720 |
| Weight | 80 g |
| Power consumption | 0.2 W (typ) 0.33 W (max) |
| Connectors | 1xRCA, 1x5 pole PHOENIX |
| ESD protection | ±8kV HBM |

S/PDIF digital audio

| | |
|------------------------------|---------------|
| Audio format | S/PDIF |
| Supported sample rates | 16 to 48 kHz |
| AES/EBU compatibility | No |
| Bit depths | Up to 24 bits |

Analog audio

| | |
|--------------------------|--------------------------|
| Sample frequency | 16 to 96 kHz |
| Maximum level | 4.4 Vp-p (6 dBu) |
| Frequency response | 20 Hz to 20 kHz: ±1 dB |
| Gain | +5dB to -73dB (and -∞dB) |
| Output impedance | 1.2 kΩ |

10.3.8. MODEX-IF-AUD

| | |
|-------------------------|--------------------------|
| Part number | 9161 0721 |
| Weight | 90 g |
| Power consumption | 0.2 W (typ) 0.33 W (max) |
| Connectors | 2xRCA, 2x5 pole PHOENIX |
| ESD protection | ±8kV HBM |

S/PDIF digital audio

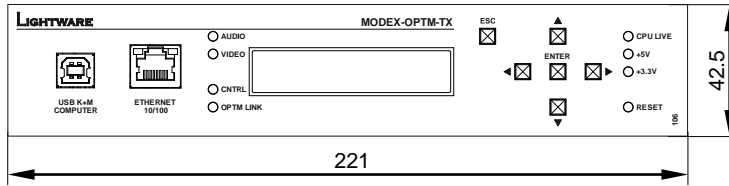
| | |
|------------------------------|---|
| Audio format | S/PDIF |
| Supported sample rates | 16 to 48 kHz (input), 16 to 48 kHz (output) |
| AES/EBU compatibility | No |
| Bit depths | Up to 24 bits |

Analog audio

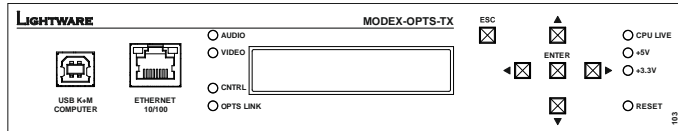
| | |
|------------------------------|---|
| Sample frequency | 16 to 96 kHz |
| Maximum level | Input: 4.4 Vp-p; output: 4.4 Vp-p (6 dBu) |
| Frequency response | 20 Hz to 20 kHz: ±1 dB |
| Gain | Input: -5dB to 19dB |
| | Output: +5dB to -73dB (and -∞dB) |
| Input/output impedance | Input: 28 kΩ; output: 1.2 kΩ |

10.4. Technical drawings

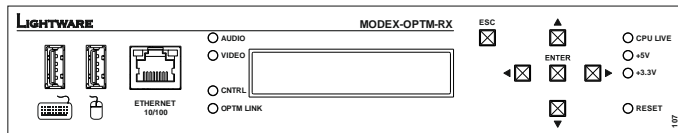
Front view (MODEX-OPTM-TX)



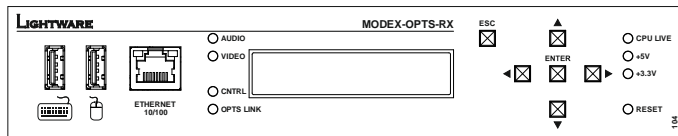
Front view (MODEX-OPTS-TX)



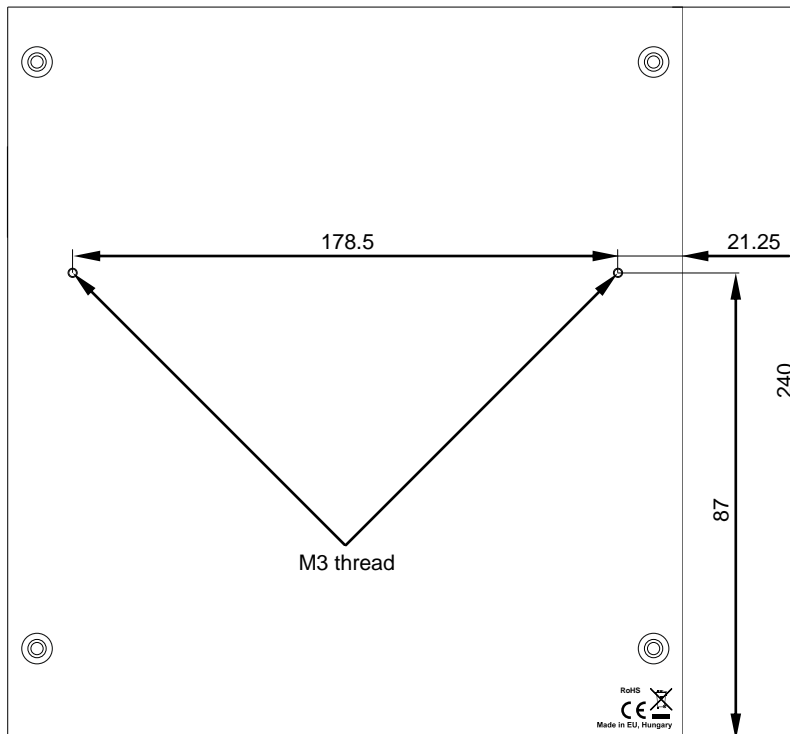
Front view (MODEX-OPTM-RX)



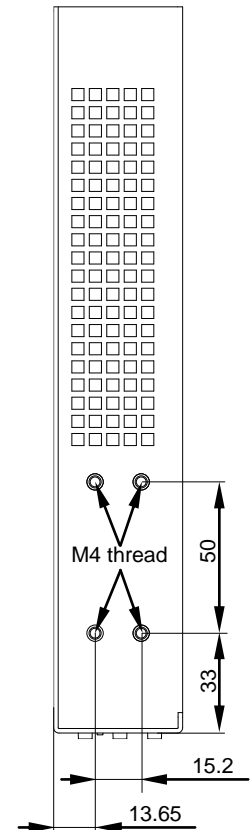
Front view (MODEX-OPTS-RX)



Bottom view



Side view



10.5. Factory default settings

10.5.1. Network settings

| Parameter | Setting/Value |
|--------------------------|---------------|
| IP address (transmitter) | 192.168.0.101 |
| IP address (receiver) | 192.168.0.102 |
| Subnet mask | 255.255.255.0 |
| Static gateway | 192.168.0.1 |
| Port number | 6107 |
| DHCP | disabled |
| HTTP port | 80 |
| WEB socket | 81 |

10.5.2. Video & Audio modules

HDMI input port

| Parameter | Setting/Value |
|------------|---------------|
| Input port | HDMI |

HDMI output port

| Parameter | Setting/Value |
|-------------|---------------|
| HDMI mode | Auto |
| Color space | Auto |
| HDCP mode | Auto |
| Color range | Auto |

10.5.3. Interface modules

Serial port (RS-232)

| Parameter | Setting/Value |
|------------------------|---------------|
| RS232 Baud rate [baud] | 9600 |
| RS232 data bits | 8 |
| Stop bits | 1 |
| Parity | None |

Infrared port

| Parameter | Setting/Value |
|----------------------------------|---------------|
| IR input carrier frequency [Hz] | 38000 |
| IR output carrier frequency [Hz] | 38000 |

Analog audio ports

| Parameter | Setting/Value |
|-------------------------------------|------------------------------|
| Application mode | (0) Analog ↔ Emb. & Ret. Aux |
| Analog in Gain [dB] (only on input) | 0 |
| Analog out Volume [dB] | 0 |
| Analog out Balance | 50% (centered) |
| Invert phase | disabled |
| DC filter | disabled |

10.5.4. EDID settings

| Parameter | Setting/Value |
|-----------|---------------|
| DVI port | F49 |
| HDMI port | F49 |

11. Troubleshooting

Usually, if the system seems not to transport the signal as expected, the best strategy for troubleshooting is to check signal integrity through the whole signal chain starting from source side and moving forward to receiver end.

At first check front panel LEDs and take the necessary steps according to their states. For more information about status LEDs refer to section [2.1.1](#) on page [10](#) and section [2.1.2](#) on page [11](#).

| Symptom | Root cause | Action | Refer to |
|--------------------------------------|---|--|--|
| Video & Audio module | | | |
| No picture on the video output port | Device(s) not powered properly | Check the extenders and the other devices if they are properly powered; try to unplug and reconnect them. | |
| | Cable connection problem | Cables must fit very well, check all the connectors. | |
| | Not the proper video port is the active one | Check the properties of the Video & Audio module. | Section 7.5.2 |
| | Not the proper interface is the active one | If the source/display has more connectors, check if the proper interface is selected. | |
| | The output is muted | Check the mute state of output port of TX and RX. | Section 7.6 |
| | Display is not able to receive the video format | Check the emulated EDID and select another (e.g. emulate the display's EDID on the input port). | Section 7.7.1 |
| | Data rate is too high for the video cable | Select a lower resolution; if the source is a computer try to modify the refresh rate (only for expert users). | |
| | HDCP is disabled | Enable HDCP on input port. | Section 7.6.3 |
| Audio interface module | | | |
| No audio is present on output | Other audio port is switched to the output | Check the crosspoint settings of audio layer. | Section 7.4 |
| | Audio application mode set to another layout | Check the Audio application mode of the Audio module. | Section 6.4.4 or section 7.5.3 |
| | Output port is muted | Check the Audio port properties. | Section 7.6 |
| | Analog audio input: volume is set very low | Check the Analog audio input port settings (Volume). | Section 6.4.4 or section 7.6.1 |
| | Analog audio output: volume is set very low | Check the Analog audio output port settings (Volume). | Section 6.4.4 or 7.6.2 |
| HDMI output signal contains no audio | HDMI mode was set to DVI | Check the properties of the output port on RX and set to HDMI or Auto. | Section 6.4.2 or section 7.6.3 |

| Symptom | Root cause | Action | Refer to |
|--|---|---|--|
| HDMI output signal contains no audio | DVI EDID is emulated | Check the EDID and select an HDMI EDID to emulate. | Section 6.7 or section 7.7 |
| Serial and Infra modules | | | |
| Connected serial device cannot be controlled | Cable connection problem | Check the connectors to fit well; check the wiring of the plugs. | Section 2.6.8 |
| | Serial settings are different | Check the serial port settings in the MODEX to meet with the requirements of the serial device. | Section 7.6.7 |
| | Serial port is muted | Check the mute state of serial port(s). | Section 7.6 |
| | Serial crosspoint is not set properly | Check the crosspoint state of Serial layer. | Section 7.4.4 |
| Connected IR device cannot be controlled | IR Emitter and/or detector connection problem | Check if the IR emitter is plugged in the IR output, and the IR detector in the IR input connector. | Section 5.1 |
| | IR carrier frequency setting is different | Check the IR settings in the MODEX to meet with the requirements of the IR device. | Section 7.6.4 |
| | IR port is muted | Check the mute state of IR port(s). | Section 7.6 |
| | Infra crosspoint is not set properly | Check the crosspoint state of Infra layer. | Section 7.4.3 |
| Front panel menu | | | |
| Navigation buttons are out of operation | LCD home screen is locked | Connect to the MODEX via the built-in web and unlock LCD. | Section 7.8.7 |
| Settings cannot be changed on front panel | Setup is disabled on front panel | Connect to the MODEX via the built-in web and unlock front panel setup. | Section 7.8.7 |
| LAN (Ethernet) | | | |
| No LAN connection can be established | Incorrect IP address is set (direct connect) | Disable DHCP server and set the IP addresses to be in the same subnet. | |
| | IP address conflict | Change the IP address to a not reserved one or enable DHCP if DHCP server exists in the network. | |
| USB | | | |
| USB device does not operate | Cables are not connected on both sides | Check the USB cable between TX and the computer. | Section 5.1 , Step 8 |
| | Not supported USB device is connected | Mostly keyboard, mouse (USB HID devices) are supported, check your device type. | Section 4.4 |

| Symptom | Root cause | Action | Refer to |
|---|--|--|---|
| Optical module | | | |
| Extenders are not linked or remote device cannot be reached | Fiber cable is connected to the not used channel | Check the connectors: from TX (Channel A) to RX (Channel B). | Section 5.1 |
| | Optical cable became contaminated | Use special fiber optical cable cleaning equipment or a soft cloth to carefully clean it. | |
| | Different firmware is installed | Check the firmware in TX and RX; the versions have to match. If necessary do firmware upgrade. | Section 7.8.3 and Chapter 9 |
| Firmware upgrade | | | |
| The extender is not listed | IP address difference | Check the IP address of MODEX and the computer: they must be under the same subnet. | Section 7.1 |
| Miscellaneous | | | |
| Crosspoint setting cannot be changed | Core module is locked | Unlock the core module via the built-in website. | Section 7.8.7 |
| Module property cannot be changed | The module is locked | Unlock the module via the built-in website. | Section 7.8.7 |

12. Warranty

Lightware Visual Engineering warrants this product against defects in materials and workmanship for a period of three years from the date of purchase.

Customer shall pay shipping charges when unit is returned for repair. Lightware will cover shipping charges for return shipments to customers.

In case of defect please contact your local representative, or Lightware at

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13. Document revision history

| Document | Release Date | Changes | Editor |
|----------|--------------|-------------------|-----------------|
| Rev 1.1 | | New modules added | Laszlo Zsedenyi |
| Rev. 1.0 | 20-03-2014 | Initial version | Laszlo Zsedenyi |